PEQUONNOCK RIVER BASIN
BRIDGEPORT, CONNECTICUT

BUNNELLS POND DAM
CT 00076

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

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AUGUST 1978

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	BUNNELLS POND
Inventory Number:	CT 00076
State Located:	CONNECTICUT
County Located:	FAIRFIELD
Town Located:	BRIDGEPORT
Stream:	PEQUONNOCK RIVER
Owner:	CITY OF BRIDGEPORT
Date of Inspection:	JUNE 7, 1978
Inspection Team:	PETER HEYNEN
	MICHAEL HORTON
	GONZALO CASTRO

The dam is an earthen embankment with a concrete corewall within the portion of the embankment to the left of the spillway. The dam is approximately 1000 feet long and rises approximately 31± feet above the streambed. The top of the dam varies from 20 to 30 feet in width and has upstream and downstream slopes at a maximum inclination of 2 horizontal to 1 vertical. There are two retaining walls at the downstream toe of the dam, one to the immediate right of the spillway and one at the extreme right end of the dam. The spillway is a 150 foot long concrete ogee section 22 feet in height from the crest to the apron. Water flows from the concrete apron to a natural sand and gravel streambed. The low level outlet is contained within the right spillway abutment. The gate to the outlet, on the upstream side of the abutment, is closed and presently inoperable. Immediately below the dam is the Glenwood Park Skating Rink and public park with an urban and residential development of Bridgeport a short distance downstream.

Based upon visual inspection at the site and past performance history, the dam appears to be in good condition. No evidence of structural instability in the retaining walls or the embankment portions of the dam was observed. However, there are some areas requiring attention.

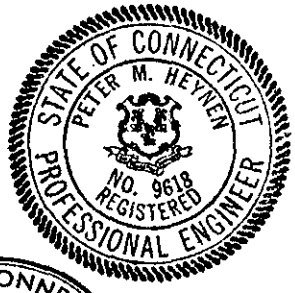
Based upon the size (Small) and hazard classification (High) in accordance with Corps guidelines, the test flood will be equal to the Probable Maximum Flood. Based upon our hydraulic computations, the spillway capacity is 12,000 cubic feet per second, which is approximately 35 percent of the Test Flood. Peak inflow to the reservoir is 35,000 cubic feet per second; peak outflow (Test Flood) is 34,000 cubic feet per second with the dam overtopped 2.7 feet. A breach of the dam would develop a 16 foot wave downstream of the dam causing flooding and severe loss of life and property damage at the skating rink located near the toe of the dam.

Based upon the rough computation in Appendix D, the dam spillway capacity will be exceeded by the Test Flood. More sophisticated flood routing should be undertaken by hydrologist/hydraulics engineers to refine the Test Flood figures. A study should be undertaken and recommendations made to increase the spillway capacity to an acceptable level based upon the refined test flood figures.

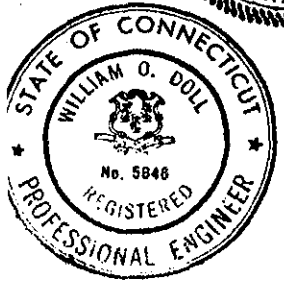
It is recommended that the low level outlet be made operable to provide an effective method for lowering the water level for maintenance and in the event of extreme high water conditions.

Trees and bushes on the upstream and downstream slopes, and in the downstream channel immediately below the spillway, should be removed. Appropriate ground over on the downstream slope, and riprap where absent on the upstream slope, should be provided for erosion protection. Measures should be taken to discourage trespassers on the downstream slope. An operation and maintenance plan should be instituted as described in Section 7.

The above recommendations and remedial measures should be instituted within 6 months of the owner's receipt of this Phase I Inspection Report.



Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.



William O. Doll, P.E.
Chief Engineer
Cahn Engineers, Inc.

This Phase I Inspection Report on Bunnells Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionarly in nature. It would be incorrect to assume that the present condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions there of. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

SECTION 7: ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

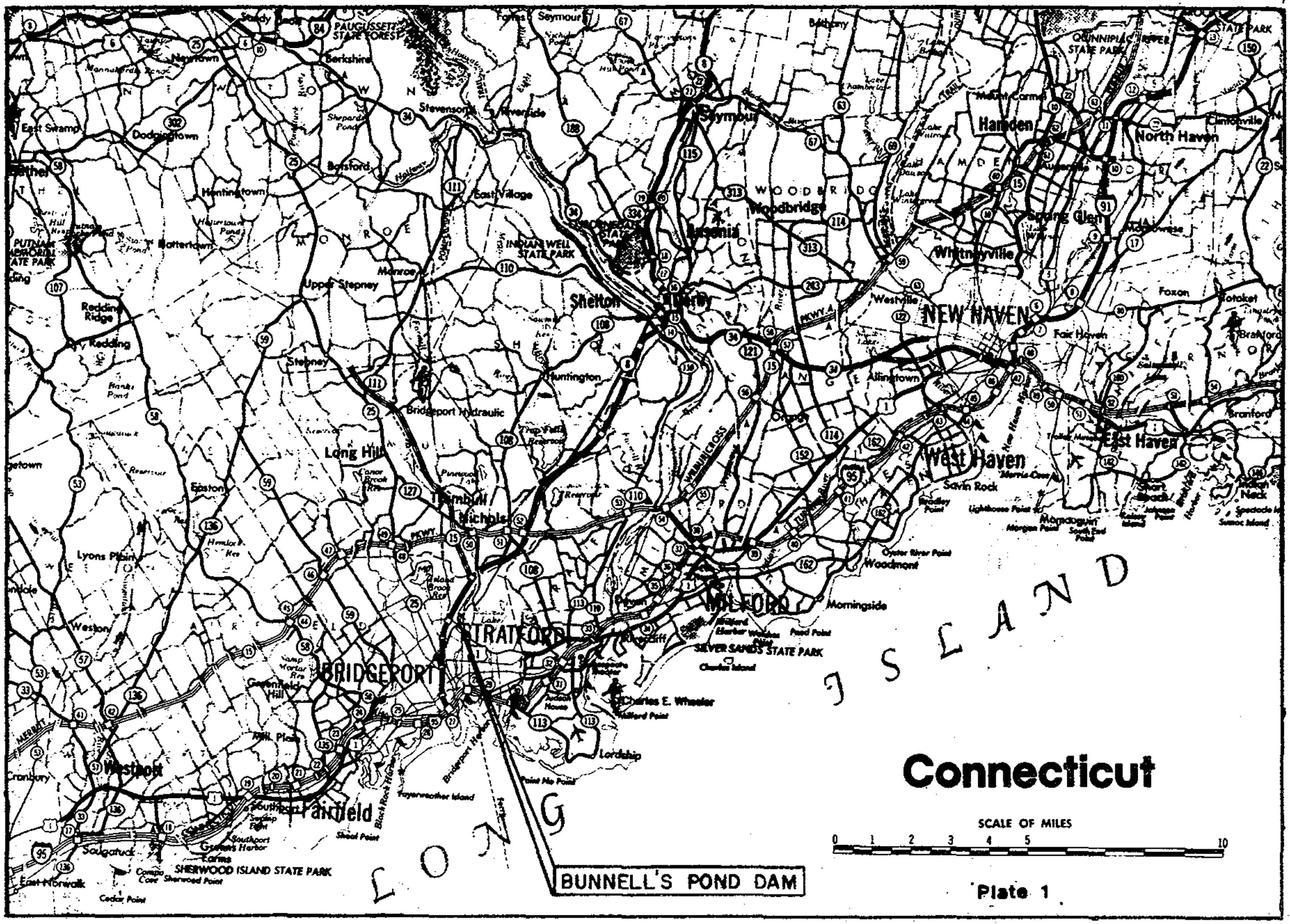
APPENDIX

Drawings

*See Special Note, Appendix Section B Availability of Data.

OVERVIEW PHOTO

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS. CAHN ENGINEERS. INC. WALLINGFORD, CONN. ARCHITECT —— ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	BUNNELLS POND DAM PEQUONNOCK RIVER	BRIDGEPORT CONNECTICUT	DATE 6/7/78 CE # 27 531 GG PAGE x


Connecticut
SCALE OF MILES
0 1 2 3 4 5 10
BUNNELL'S POND DAM
LONG ISLAND
NEW HAVEN
BRIDGEPORT
STRATFORD
MILFORD
West Haven
East Haven
Hamden
North Haven
Shelton
Derby
Ansonia
Seymour
Woodbridge
Whitneyville
Trumbull
Nichols
Long Hill
Fairfield
Westport
Newtown
Monroe
Easton
Weston
Lordship
Orange
Allingtown
Westville
Fair Haven
Branford
SILVER SANDS STATE PARK
SHERWOOD ISLAND STATE PARK
INDIAN WELL STATE PARK
PAUGUSSETT STATE FOREST
QUINNIPIAC RIVER STATE PARK
Plate 1

DRAINAGE AREA
25.0 SQ.MI.

BUNNELLS POND
DAM

INITIAL IMPACT AREA
GLENWOOD PARK
SKATING RINK

N

USGS QUADRANGLES
BRIDGEPORT 1970
LONG HILL 1973
BOTSFORD 1972
WESTPORT 1971

PLATE NO. 2

CAHN ENGINEERS INC. WALLINGFORD, CONNECTICUT ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORP OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

BUNNELLS POND DAM

PEQUONNOCK RIVER BRIDGEPORT, CONNECTICUT

Dwn. BY	Ckd. By	App. By	SCALE 1"= 4000'
J.P.	D.T.	P.H.	DATE 8/12/78

PHASE I INSPECTION REPORT

BUNNELLS POND DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the southwestern portion of the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of April 26, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0310 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

(1) Perform technical inspection and evaluation non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

(1) Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features on the dam which need corrective action and/or further study.

1.2 Description of Project

a. Description of Dam and Appurtenances - The dam is an earth embankment with a concrete corewall within the portion of the embankment to the left of the spillway. The dam is approximately 1000 feet long and rises 31+ feet above the streambed. The top of the dam varies from 20 to 30 feet in width and has upstream and downstream slopes at maximum inclinations of 2 horizontal to 1 vertical. There are two retaining walls at the downstream toe of the dam, one to the immediate right of the spillway is concrete, and one at the extreme right end of the dam is of stone masonry and concrete. The wall at the extreme right is part of the remains of an old paper mill and pump station. The spillway is a 150 foot long concrete ogee section 22 feet in height from the crest to the apron. According to existing data, the spillway section is built on a gravel foundation with a pile cut-off at the downstream toe. There is no evidence on existing plans or at the site of bedrock or outcrops. The streambed is natural sand and gravel.

The low level outlet and intake structure is contained within the right spillway abutment. The gate to the outlet, on the upstream side of the abutment is closed and presently inoperable.

b. Location - The dam is located on the Pequonnock River is an urban/residential area of the City of Bridgeport, County of Fairfield, State of Connecticut. The

dam is shown on the Bridgeport U.S.G.S. Quadrangle Map as having coordinates of longitude W73° 11' 15" and latitude N41° 12' 24".

c. Size Classification - SMALL - The dam has approximate storage of 800 ± acre feet at the top of dam, approximate elevation 43, which is approximately 30± feet above the elevation of the streambed. According to the Recommended Guidelines, a dam with storage of less than 1000 acre feet is considered small.

d. Hazard Classification - HIGH - (Category I) The skating rink at the toe of the dam and the urban/residential developments of Bridgeport located downstream of the dam provides potential for severe loss of life and excessive economic loss should the dam breach.

e. Ownership - City of Bridgeport
45 Lyon Terrace
Bridgeport, Connecticut
~~Kenneth A. Vozzo~~ Barry Skinner Ass. City Engineer
as of 12/82
8- Phone (203) 576-7211 (direct F.T.S.)

f. Purpose of Dam - Recreational - Beardsley/Glenwood Parks.

g. Design and Construction History - The following information is believed to be accurate based on the plans and correspondence available and included in the Appendix.

The original dam was built prior to 1905 and was the site of a paper mill. The present dam was constructed in 1906 for the Bridgeport Hydraulic Company, and has since been aquired by the City of Bridgeport. The present dam was constructed after the dam previously located at the site failed during the July, 1905 flood. Plans of the pre-1905 dam are included in the Appendix, Section B.

h. Normal Operational Procedures - Other than the low level outlet which is inoperable, there appears to be no means of regulating the level of water in the pond.

1.3 Pertinent Data

a. Drainage Areas - 25 square miles. Rolling terrain in wooded and residential area.

b. Discharge at Dam Site - Maximum known flood - Not Known. Total spillway capacity at elevation 43 (top of dam) is 12,000 cfs.

c. Elevation - (Ft. above MSL, USGS Datum)

Top of Dam:	43±
Spillway Crest:	35.5±
Streambed:	12±
Low Level Outlet:	12±

d. Reservoir - Length of Normal Pool: 4000 ft.
Length of Maximum Pool: 4000 + ft.

e. Storage - At Elevation 35.5 450 acre ft.
At Elevation 43 800 acre ft.

f. Reservoir Surface -

At Elevation 35.5	47 acres
At Elevation 43	47+ acres

g. Dam - Type: Earthen embankment with corewall to the left of the spillway.

Length:	1000 ± feet
Height:	31± ft. above streambed.
Top Width:	20-30 feet.
Side Slope:	Upstream 2H to 1V (Max.)
	Downstream 2H to 1V
Core:	Partial concrete core. (left of spillway)
Cutoff:	None Known

h. Diversion and Regulatory Tunnel - Not Applicable.

i. Spillway - Type: Concrete ogee section.
Length of Weir: 150'
Crest Elevation: 35.5
Upstream Channel: 2.5H to 1V

j. Regulatory Outlets

Low Level Intake and Outlet:	Located in right concrete spillway abutment; gate opened by hand-operated winch on top of abutment-presently inoperable.

SECTION 2: ENGINEERING DATA

2.1 Design

a. Available Data - The available data consists of drawings, correspondence, and records by the State of Connecticut, the City of Bridgeport, Clarence Blair Associates, Frank Ragaini, Bridgeport Hydraulic Company, William H. O'Brien III, Buck and Buck Engineers, S.E. Minor & Co., Inc., and others.

b. Design Features - The maps, drawings and reports included in the Appendix show the design features of the dam as stated previously herein.

c. Design Data - There were no engineering values, assumptions, test results or calculations available for the 1906 construction.

2.2 Construction

a. Available Data - "As-Built" plans were not available for the 1906 construction.

b. Construction Considerations - No information was available.

2.3 Operation

There are no formal operation records known to exist.

2.4 Evaluation

a. Availability - Existing data was provided by the State of Connecticut and the owner. The owner made the operations available for visual inspection.

b. Adequacy - The engineering data available was not sufficient to perform an in-depth assessment of the dam. Therefore, the final assessment of this investigation must be based primarily on visual inspection, performance history and hydraulic/hydrologic assumptions.

c. Validity - A comparison of record data and visual observations reveals no observable significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - In general, the dam appears to be in good condition, however, there are some areas in need of maintenance.

b. Dam

Upstream Slope - The upstream slope is mostly covered with hand-placed riprap and a dense growth of bushes and trees with trunk diameters up to 3-in. The riprap is not visible at most locations due to the vegetation cover. Within approximately 25 feet of the spillway walls, a different, larger size riprap is in place which leaves areas between the stones unprotected. Apparently this riprap was placed after erosion and loss of the original riprap. However, the new riprap is not immediately adjacent to the old riprap, and there are zones with no protection between the new and old riprap areas.

Crest - The crest of the dam is in good condition with no evidence of cracks or erosion. It appears, however, that the elevation of the crest is about one foot below the top of the spillway abutment near the right abutment and at the right end of the dam.

Downstream Slope - The downstream slope is heavily covered with bushes and trees. The absence of grass under tree-covered areas has allowed some minor sloughing and erosion. An erosion channel against the left wall of the spillway has been covered with cement mortar. Erosion has also developed along footpaths on the downstream slope along the full length of the dam, but more severely in the area to the right of the spillway. There are no wet spots or other evidences of seepage on the downstream slope or downstream of the dam.

At the right end of the dam, there are two retaining walls in good condition, one consisting of stone and concrete sections, and the other a concrete section.

e. Downstream Channel - The downstream channel is the natural river bed and is, in general, in good condition. However, there are large trees growing immediately downstream of the spillway apron which collect debris resulting in a significant obstruction to the flow of water.

Some minor erosion of the left bank has probably been caused by the obstruction of the flow.

f. Operating Facilities - The low level outlet is inoperative.

3.2 Evaluation

A visual inspection of the dam was sufficient to indicate that, the condition of the dam is generally good, however, there are some areas which require attention.

1. The trees and bushes growing on the upstream slope can present, in the future, a seepage problem. The tree roots can create seepage paths for the water if the trees are allowed to grow without limit.

2. The trees growing in the downstream slope have prevented grass growth under the trees which has allowed a small amount of erosion to occur.

3. Trespassing on parts of the downstream slope has created footpaths which in turn have concentrated the flow of rainwater creating, in places, erosion gullies to one foot in depth.

4. Trees growing downstream of the spillway restrict flows and cause retention of debris. As a result, some erosion of the left bank of the channel has occurred. In the event of a large flood, this debris could retain some water which could be suddenly released causing additional flooding.

5. The actual freeboard available should be measured at the right end of the dam where the crest of the dam is about one foot lower than it is near the spillway.

6. The upstream slope has small areas not protected by riprap.

7. The low level outlet is inoperative.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Regulating Procedure

The low level outlet is not operational, therefore there is no apparent way to regulate the water level in the pond.

4.2 Maintenance of Dam

There was no evidence of regular maintenance being done at the time of our inspection. Heavy growths of vegetation and numerous trees were observed on an around the dam as noted in Section 3.

4.3 Maintenance of Operating Facilities

No regular maintenance of operating facilities was evident at the time of our field investigation.

4.4 Description of any Warning System in Effect

No formal warning system is in effect.

4.5 Evaluation

A formal program of operation and maintenance procedures should be instituted, to include complete documentation to provide records for future reference. Specific areas requiring maintenance include 1) the inoperative low level outlet, 2) the heavy vegetation and trees on the dam and in the downstream channel, and 3) the areas on the upstream face which are not riprapped and are therefore unprotected from erosion.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - No computations could be found for the 1906 construction. Hydraulic/hydrologic computations were available from inspections and reports performed since construction to evaluate hydraulic adequacy of the dam, and are included in Appendix Section B.

b. Experience Data - During the July, 1905 flood, the dam previously at the site failed. There has been no evidence of serious problems since construction of the present dam was completed in 1906.

c. Visual Observations - The trees growing in the downstream channel could hinder or obstruct flow and cause erosion of the channel banks. Some evidence was noticed of this already having occurred.

d. Overtopping Potential - The Test Flood for this high hazard small size dam is equal to the Probable Maximum Flood (PMF) of 34,000 cfs.

Based upon our hydraulics computations, the spillway capacity is 12,000 cubic feet per second (Appendix D-10). Based upon "Preliminary Guidance for Estimating Maximum Probably Discharges" dated March 1978, peak inflow to the reservoir is 35,000 cubic feet per second (Appendix D-7); peak outflow (Test Flood) is 34,000 cubic feet per second with the dam overtopped 2.7 feet (Appendix D-14).

e. Spillway Adequacy - The spillway will pass approximately 35 percent of the Test Flood at elevation 43 (top of dam elevation).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - No evidence of structural instability was observed.

b. Design and Construction Data - There is not enough design and construction data to permit a formal evaluation of the dam stability.

c. Operating Records

There is no recorded information indicating past stability problems since the completion of construction in 1906.

d. Post-Construction Changes - The degree of stability of the dam decreased temporarily with no detrimental effects during construction of the Glenwood Park Skating Rink located at the downstream toe. The completed skating rink actually improves stability due to the perimeter drain incorporated in the rink building design.

e. Seismic Stability - Bunnells Pond Dam is in Seismic Zone 1 and hence needs not be evaluated for seismic stability according to the Recommended Guidelines.

SECTION 7: ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - Based on a review of available information and a visual inspection, the dam appears in good condition. There are, however, some features which could influence the future stability of the dam if they are not corrected as recommended below.

Based upon our hydraulics computations, the spillway capacity is 12,000 cubic feet per second, which is equivalent to approximately 35 percent of the Test Flood. Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March 1978, peak inflow to the reservoir is 35,000 cubic feet per second; peak outflow is 34,000 cubic feet per second with the dam overtopped 2.7 feet. A breach of the dam would develop a 16 foot wave immediately downstream of the dam, which would cause severe loss of life and property damage at the Glenwood Park Skating Rink located at the toe of the dam.

b. Adequacy of Information - The information available is not sufficient to analyze the stability of the dam. An assessment of the dam must thus be based solely on a visual inspection, which cannot disclose all potential problems the dam may develop in the future.

c. Urgency - The recommendations presented should be implemented within the time frames specified in Sections 7.2 and 7.3.

d. Need for Additional Information - There is a need for additional information as described in Section 7.2.

7.2 Recommendations

The recommendations presented in this section should be implemented with 6 months of the owner's receipt of this Phase I Inspection Report.

1. Repair and reactivate the low level intake to allow the reservoir water level to be lowered in cases of emergency or for maintenance.

2. Based upon the rough computation in Appendix D, the dam spillway capacity will be exceeded by the Test Flood. More sophisticated flood routing should be undertaken by hydrologist/hydraulics enigneers to

refine the Test Flood figures. A study should be undertaken and recommendations made to increase the spillway capacity to an acceptable level based upon the refined Test Flood figures.

7.3 Remedial Measures

a. Alternatives - This study has identified no practical alternatives to the above recommendations.

b. Operation and Maintenance Procedures - The following measures must be undertaken within 6 months of the owner's receipt of this report and continued on a regular basis.

1. Trees and bushes on upstream slope should be cut.

2. Trees should be removed from the downstream slope and either grass or low vegetation should be planted to prevent erosion. Measures must be taken to discourage trespassers on the downstream slope to decrease erosion of the slope.

3. Trees growing in the spillway channel should be removed so as to prevent the hindrance or obstruction of flow and possible channel erosion.

4. Riprap protection should be installed on the upstream face of the dam in areas which are presently unprotected.

5. A formal program of operation and maintenance procedures should be instituted, and fully documented to provide accurate records for future reference.

6. The periodic inspections of the dam that have been conducted should be continued on a more regular basis, at least once every two years, by an inspector qualified in dam inspection.

7. Round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

APPENDIX

SECTION A: VISUAL OBSERVATIONS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Bunnells Pond Dam

DATE: June 7, 1978

TIME: 8:30 a.m.

WEATHER: Cloudy, 70°

W.S. ELEV. 35.5 **U.S.** 13 **DN.S**

PARTY:	INITIALS:	DISCIPLINE:
1. Mike Horton	MH	Structural
2. Gonzalo Castro	GC	Geotechnical
3. Peter Heynen	PH	Party Chief
4.		
5.		
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Earth and Masonry (or Concrete) Core Dam Embankment	GC/MH/PH	
2.	Spillway-Approach, Channel, Weir, Discharge Channel	GC/MH/PH	
3.	Outlet Works-Inlet Channel and Inlet Structure	MH/PH	
4.	Outlet Works-Outlet Structure and Outlet Channel	GC	
5.	Reservoir	PH	
6.	Operation and Maintenance	PH	
7.	Safety and Performance Instrumentation	PH	
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Earth and Masonry (or Concrete) Core Dam Embankment

AREA EVALUATED	BY	CONDITION
Crest Elevation	PH	Elevation varies-low point at right end of abutment, see plan.
Current Pool Elevation	PH	One (1) inch over spillway crest.
Maximum Impoundment to Date	PH	Not known-Dam failed in 1905 at left abutment. City owned.
Surface Cracks	GC	None.
Pavement Condition	GC	No pavement.
Movement or Settlement of Crest	GC	None apparent.
Lateral Movement	GC	None apparent.
Vertical Alignment	GC	Crest near right abutment is about one (1) ft. lower than next to spillway.
Horizontal Alignment	GC	No observable misalignment.
Condition at Abutment and at Masonry Structures	GC	Some erosion next to spillway walls.
Indications of Movement of Structural Items on Slopes	GC	None observed.
Trespassing of Slopes	GC	Several footpaths on downstream slope.
Sloughing or Erosion of Slopes or Abutments	GC	Some erosion along footpaths on downstream slope.
Rock Slope Protection-Riprap Failures	GC	None observed.
Unusual Movement or Cracking at or near Toes.	GC	None observed.
Unusual Embankment or Downstream Seepage	GC	None observed.
Piping or Boils	GC	None observed.
Foundation Drainage Features	GC	None apparent.
Toe Drains	GC/PH	Drawing indicates rock toe, not observed Skating rink reported to have foundation underdrains. They are frozen most of the year.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Earth and Masonry (or Concrete) Core Dam Embankment

AREA EVALUATED	BY	CONDITION
Instrumentation Systems	GC	None known.
Vegetation	GC	Heavy tree and brush cover on downstream slope and exposed portion of upstream slope.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Spillway-Approach, Channel, Weir, Discharge Channel

AREA EVALUATED	BY	CONDITION
a. Approach Channel	GC/PH	If present, not visible, reservoir was full.
General Condition		
Loose Rock Overhanging Channel		
Trees Overhanging Channel		
Floor of Approach Channel		
b. Weir and Training or Sidewalls		
General Condition of Concrete	MH	Good.
Rust or Staining	MH	None.
Spalling	MH	Slight amount.
Any Visible Reinforcing	MH	None.
Any Seepage or Efflorescence	MH	Yes-minor.
Drain Holes	GC	None observed.
c. Discharge Channel		
General Condition	GC/PH	Good-left side eroded.
Loose Rock Overhanging Channel	GC	None.
Trees Overhanging Channel	GC/PH	Yes-across and in channel.
Floor of Channel	GC	Stone blocks at apron, then natural gravelly stream bottom.
Other Obstructions	GC	Trees growing at end of spillway apron.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Outlet Works-Inlet Channel & Inlet Structure

AREA EVALUATED	BY	CONDITION
a. Approach Channel		NA
Slope Conditions		NA
Bottom Conditions		NA
Rock Slides or Falls		NA
Log Boom	PH	None apparent.
Debris		NA
Condition of Concrete Lining		NA
Drains or Weep Holes		NA
b. Intake Structure	PH/ MH	Inlet structure in right abutment blocked. Gate is not operable. No leakage apparent.
Condition of Concrete		
Stop Logs and Slots	PH	Inlet submerged-none apparent.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Outlet Works-Outlet Structure and Outlet Channel

AREA EVALUATED	BY	CONDITION
General Condition of Concrete	PH	Good.
Rust or Staining	PH	None observed.
Spalling	PH	Minor
Erosion or Cavitation	PH	None observed.
Visible Reinforcing	PH	None observed.
Any Seepage or Efflorescence	PH	None observed.
Condition at Joints	PH	Good.
Drain Holes	PH	None observed.
Channel	GC	Low level outlet discharges into spillway channel. See comments under spillway channel.
Loose Rock or Trees Overhanging Channel	PH	Debris at outlet.
Condition of Discharge Channel	PH	Good-inspected only first 1/3rd of channel.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Reservior

AREA EVALUATED	BY	CONDITION
Shoreline	PH	Surrounded by grassed areas and deciduous vegetation.
Sedimentation	PH	Not observable.
Potential Upstream Hazard Areas	PH	None known.
Watershed Alteration-Runoff Potential	PH	Developing residential/urban area.

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Operations and Maintenance

AREA EVALUATED	BY	CONDITION
a. Reservoir Regulation Plan	PH	No representive was at dam.
Normal Conditions		
Emergency Plans	PH	To our knowledge no plans are in existance.
Warning System		
b. Maintenance (Type) (Regularity)	PH	It appears to be on an as needed basis.
Dam		
Spillway		
Outlet Works		

PERIODIC INSPECTION CHECK LIST

PROJECT Bunnells Pond Dam **DATE** June 7, 1978

PROJECT FEATURE Safety and Performance Instrumentation

AREA EVALUATED	BY	CONDITION
Headwater and Tailwater Gages	PH	None.
Horizontal and Vertical Alignment Instrumentation (Concrete Structures)	PH	None.
Horizontal and Vertical Movement, Consolidation, and Pore-Water Pressure Instrumentation (Embankment Structures)	PH	None.
Uplift Instrumentation	PH	None.
Drainage System Instrumentation	PH	None.
Seismic Instrumentation	PH	None.

APPENDIX
SECTION B: EXISTING DATA

SPECIAL NOTE

SECTION B

AVAILABILITY OF DATA

The correspondence listed in the summary of contents and the plans listed in the Table of Contents, Appendix Section B, are included in the master copy of this report, which is on file at the office of the Army Corps of Engineers, New England Division, in Waltham, Massachusetts.

Only the following correspondence is included in this report.

Date	To	From	Subject	Page
July 7 1965	Water Resources Commission	Roger C. Brown	Report of In- spection of Dam	B-17
Feb. 1 1967	Water Resources Commission	F. Ragaini, Clarence Blair, Assoc.	Flood Control Report of Pequonnock River	B-23
Jan. 30 1974	Victor F. Galgowski	Edward F. Ahneman Jr Chief Eng., SE Minor & Co.,Inc., Civil Engs.	Report of Inspection of Dam	B-62
Feb. 6 1974	Raymond Mathews	Victor F. Galgowski	Recommended Maintenance of Dam	B-69

APPENDIX B - EXISTING DATA

SUMMARY OF CONTENTS

DATE	TO	FROM	SUBJECT	PAGE
Sept. 20, 1968	Frank Ragaini	William H. O'Brien III Civil Engineer, Water Resources Commission[2]	Request for copies of all Plans and Specifications on Bunnell's Pond Dam	B-40
Sept. 23, 1968	Russell F. Neary	William H. O'Brien III[1]	Request for Set of Plans & Specifications for Ice-skating Rink	B-41
Oct. 3, 1968	William H. O'Brien III	Joseph A. Williams, Director of Parks and Recreation, City of Bridgeport[2]	Transmittal of Plans & Specifications for Ice-skating Rink	B-42
Oct. 8, 1968	William H. O'Brien III	Roger C. Brown[2]	Transmittal of Plans for Dam	B-43
Nov. 22, 1968	Chief Engineer, Bridgeport Hydraulic Co.	William H. O'Brien III[1]	Request for Available Information about Bunnell's Pond Dam	B-44
Nov. 26, 1968	Joseph Williams	William H. O'Brien III[1]	Effect of Ice-skating Rink on Safety of Dam	B-45
Dec. 11, 1968	William H. O'Brien III	Donald W. Loiselle Bridgeport Hydraulic Co.[2]	Response to Request for Plans which were turned over to City of Bridgeport	B-46
Mar. 16, 1970	John. J. Curry	Joseph A. Williams[2]	Effects of Routes 8 & 25 on the Dam	B-47
Apr. 10, 1970	John J. Curry	Joseph A. Williams[2]	Request for Response to Letter of Mar. 16, 1970	B-48
May 7, 1970	James C. Spencer State Dept. of Transportation	William H. O'Brien III[1]	Effects of Highway on the Dam	B-49

-----	TO	FROM	SUBJECT	PAGE
Nov. 27, 1972	Victor F. Galgowski	Elmer J. Toth[2]	Notification that Recommended Work will be done during Summer of 1973	B-59
Dec. 1, 1972	James Thompson	William H. O'Brien[2]	Inquiry into Inspection of Dam as per Letter of June 15, 1972	B-60
Jan. 10, 1974	Water Resources Commission	Raymond Mathews, Acting Director of Parks & Recreation, City of Bridgeport[2]	Request for Inspection of Dam	B-61
Jan. 30, 1974	Victor F. Galgowski	Edward F. Ahneman Jr., Chief Engineer, S.E. Minor & Co.,Inc. Civil Engineers[2]	Report of Inspection of Dam	B-62
Jan. 31, 1974	Victor F. Galgowski	Edward F. Ahneman[2]	Transmittal of Three Copies of Report on Bunnell's Pond Dam	B-68
Feb. 6, 1974	Raymond Mathews	Victor F. Galgowski[2]	Recommended Maintenance of Dam	B-69
July 9, 1974	Victor F. Galgowski	Theodore W. Nowlan Director of Parks and Recreation[2]	Notification of Work to be done on Dam	B-71
July 16, 1974	Theodore W. Nowlan	Victor F. Galgowski[2]	Acknowledgement of Maintenance Work being done on Dam	B-72
Jan. 6, 1977	Victor F. Galgowski	Francis E. Fagan, Superintendent, Parks and Recreation[2]	Query into when next Scheduled Inspection will take place	B-74

		FROM	SUBJECT	PAGE
Jan. 25, 1977	Victor F. Galgowski	Joseph J. Obara, Sr. Civil Engineer, Environmental Protection[2]	Scheduling of a Periodic Inspection to be Performed in Spring	B-75
Jan. 25, 1977	Francis E. Fagan	Victor F. Galgowski[2]	Plans to Inspect Dam when Weather Conditions Improve	B-76

[1]Obtained from City of Bridgeport

[2]Obtained from State of Connecticut Water Resources Commission.

CLARENCE BLAIR ASSOCIATES

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...BER G. BROWN
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...ANK RABAINI

...RENCE M. BLAIR
(1904-1964)

CHARLES E. AUGUR, JR.
GORDON MILDER
JOHN M. BRENT
DONALD L. DIBBROW
NICHOLAS PIPERAS, JR.

July 7, 1965

State of Connecticut
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Re: BUNNELL'S POND DAM
BRIDGEPORT

Gentlemen:

Herewith is a report on Bunnell's Pond Dam on the Poquonock River in Bridgeport:

1. IDENTIFICATION

This report was made at the request of Mr. William P. Sander in a letter dated May 10, 1965.

An inspection of the structure was made by the writer and an assistant engineer on June 17, 1965.

The dam is known as Bunnell's Pond Dam and is located in Beardsley Park, in the City of Bridgeport, on the Poquonock River about 1500 feet northerly of Route 1A and 1000 feet westerly of the Huntington Turnpike.

Latitude	41-12-24
Longitude	73-11-15

The owner is the City of Bridgeport.

2. FACTORS OF HAZARD

Failure of this dam would result in a disaster to a portion of the City of Bridgeport.

This would be true whether failure occurred during a flood or during ordinary flows.

Immediately below the dam the flood plain is relatively wide and would store some flood flow. Approximately 1500' downstream from the dam the stream passes under Route 1A, through a bridge with an inadequate waterway. From this bridge downstream to tide water, the stream channel is winding, narrow and cluttered with debris. At one location, the stream passes under a large store. A dam failure, or indeed a major runoff, would, in my opinion, cause serious damage at and downstream from Route 1A.

In my opinion, the breaking away of this dam would endanger life.

2. STRUCTURE

The dam was built and formerly owned by the Bridgeport Hydraulic Company and plans are on file in the office of Clarence Blair Associates in New Haven. These plans were spot checked at the site and apparently show the dam as built. Plans are dated 1906. The structure has a total length of about 1000 feet. A concrete overflow spillway is 150 feet long with an embankment section 140 feet long on its easterly end and an embankment 710 feet long on the west.

The spillway is a concrete ogee, gravity section 22 feet in height from the apron to the crest. Freeboard from the crest to the top of abutment walls is 7.5 feet.

The embankment at the east end of the spillway has a top width of 20 feet and both upstream and downstream slopes of 1 vertical on 2 horizontal. According to the plans this embankment has a concrete corewall.

The west embankment has a top width of 30 feet, slopes of 1 on 2 and is thought <u>not</u> to have a corewall. Both east and west embankments are protected on the upstream side by riprap.

According to the plans on file, the spillway section is built on a gravel foundation with a sheet piling cut-off at the downstream toe.

There is no evidence on the plans or at the site of ledge rock.

The spillway is 150 feet long and if effective to the top of the wingwalls would be 7.5 feet deep. There is, however, a section of the embankment at the extreme westerly end of the dam which is lower than the top of the wingwalls. This low spot in the embankment is the control point with an elevation 6.6 feet above the spillway crest. Effective depth of the spillway is then 6.6 feet and the estimated discharge capacity at this depth is 9500 cfs.

B-18

At a depth over the spillway of more than 6.6 feet, water would flow over the low spot at the westerly end of the embankment into the street (Sylvan Avenue). The portion of the embankment which is below grade is not over 50 feet long and could easily be brought up to the grade of the remainder of the embankment.

There was no evidence of leakage or seepage at any point.

Concrete surfaces have evidently been covered with "gunnite" and are in excellent shape and without cracks.

A small amount of erosion has taken place at some points on the downstream slope of the embankment. One such place is at the south line along the downstream toe of the east embankment.

4. HYDROLOGY

The natural drainage area tributary to this dam site is 24.6 square miles. The Bridgeport Hydraulic Company diverts to Easton Reservoir the runoff from 4.3 square miles of drainage area of the West Branch of the Poquonock River. We have considered the drainage area at the dam to be 24.6 - 4.3 = 20.3 square miles.

We have estimated a design discharge by the Bigwood-Thomas formula. This computation is shown on an attached sheet.

The mean annual flood flow is 715 cfs.

Using a ratio of 3.7 for a 100 year frequency, the design flood is 2650 cfs.

As previously stated, we estimate the discharge capacity of the spillway at the maximum depth before water overtops the low point of the embankment, to be 9500 cfs.

In our opinion, the spillway has ample discharge capacity.

5. SAFETY

In my opinion the dam is safe at the present time. It should be inspected periodically because of its size and its location just upstream from a closely populated area.

6. REQUIREMENTS

No work is required at the present time to put the dam in a safe condition.

It would be advisable from a maintenance standpoint to stabilize, by paving or otherwise, some of the erosion channels on the downstream slope, particularly the one along the downstream toe of the east embankment to prevent deepening of the erosion.

It would also be advisable to cut a few bushes and young trees on the embankment slopes.

7. SUMMARY OF FACTS

Bunnell's Pond Dam is located on the Poquonock River about 1500 feet north of Route 1A in the City of Bridgeport, Connecticut.

Channel conditions at Route 1A and downstream from that point are such that breaking away of the dam would cause major damage and endanger life. The dam was inspected by the writer on June 17, 1965 and is in good condition.

Plans dated 1906 are available and appear to be the plans by which the dam was rebuilt after a former dam at approximately the same location had failed during the "Bridgeport Flood" of July 1905.

The dam consists of a concrete overflow spillway 150 feet long and 7.5 feet deep with earth embankment at each end. The embankment westerly of the spillway is approximately 710 feet long and the easterly embankment approximately 140 feet long.

According to the plans the easterly embankment has a concrete corewall. The westerly embankment is thought not to have a corewall.

A low spot in the westerly embankment reduces the effective depth of the spillway to 6.6 feet. At this depth the spillway is estimated to have a discharge capacity of 9500 cfs.

8. CONCLUSION

I have inspected Bunnell's Pond Dam and found it to be in very good condition. Spillway capacity is estimated to be ample and in my opinion the dam is safe.

9. RECOMMENDATION

No orders of letters of advice are necessary but it might be well to forward to the owner the maintenance suggestions in Section 6.

Respectfully submitted,

Roger C. Brown

Roger C. Brown
Consulting Engineer

FLOOD CONTROL REPORT
of
PEQUONNOCK RIVER
Bridgeport and Trumbull, Connecticut
prepared for the
Connecticut Water Resources Commission
1967

Frank Ragaini, Engineer
93 Whitney Avenue
New Haven, Connecticut

February 1, 1967

B-23

CONTENTS

DRAWINGS

FLOOD CONTROL STUDY
PEQUONNOCK RIVER
Trumbull and Bridgeport, Connecticut

A. INTRODUCTION

A-1. General

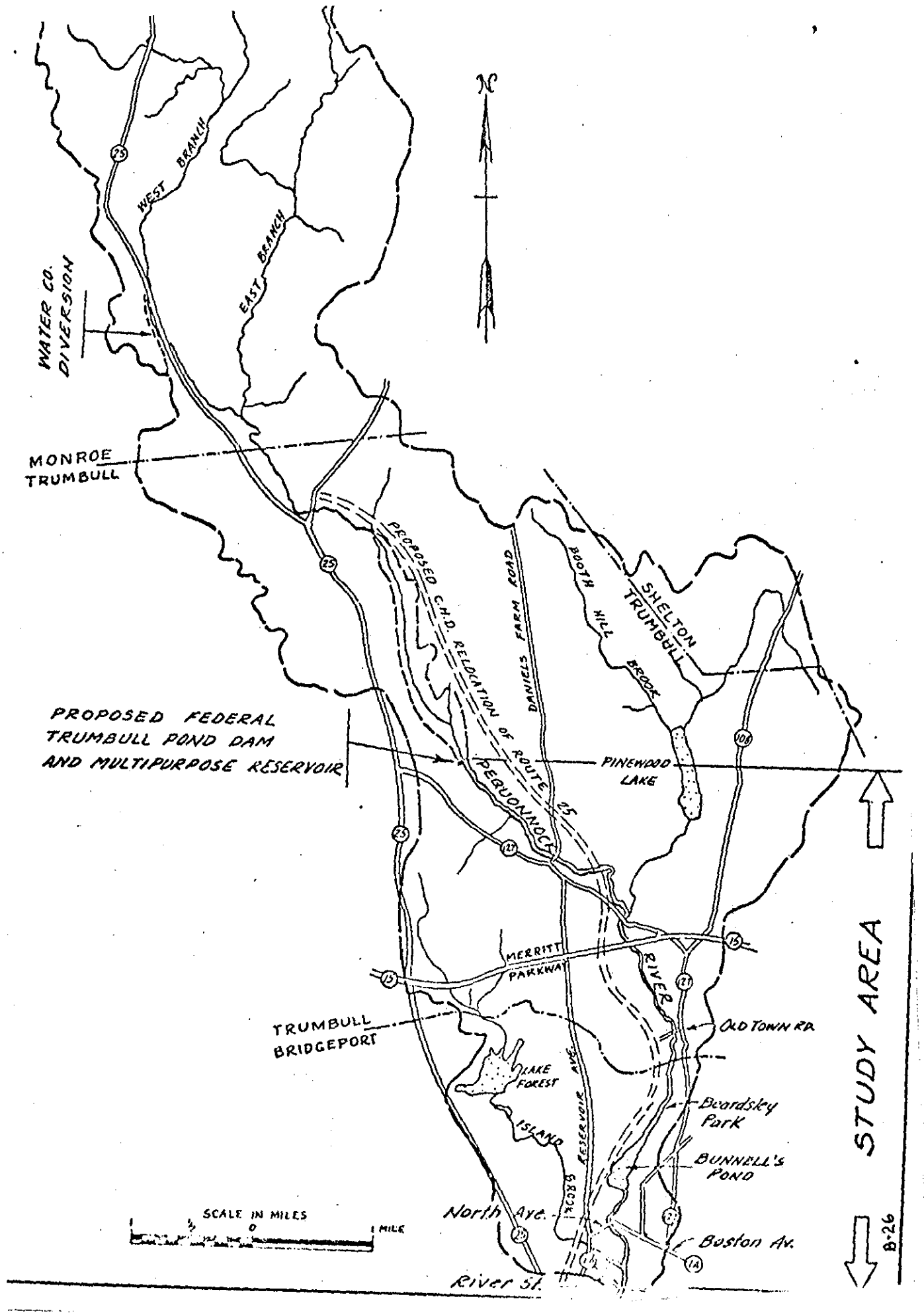
The area covered by this study and report has been subjected to serious flooding by a number of major storms dating back to July, 1905. The following is taken from a report of the U.S. Corps of Engineers entitled "Pequonnock River, Connecticut", dated September 15, 1965: "Major floods in the Pequonnock River basins have usually been caused by heavy rainfall associated with storms of tropical origin which have traveled north along the Atlantic coast. Serious flooding was recorded as early as 1905, when a July flood damaged and destroyed bridges and dams, inundated business establishments, swept away homes, and caused two deaths. Other major floods occurred in March 1936, September 1938, December 1948, and August and October 1955. The greatest flood for which there are extensive records is the October 1955 flood caused by a storm centering over southwestern Connecticut

The 1905 storm deposited over 11 inches of rainfall in 18 hours in the City of Bridgeport, this being the heaviest downpour ever recorded in the city. The storm of October 14 to October 17, 1955 resulted from a rainfall of about 9 inches. In the lower part of the basin the excessive runoff was accompanied by abnormally high tides. The flood caused considerable damage to residential and commercial property along the river. North Avenue, at the bridge which spans the river, was under about 6 feet of water.

The U.S. Corps of Engineers has recommended to the Secretary of the Army that construction of a "dam and reservoir on the Pequonnock River at Trumbull, Connecticut be authorized for the purpose of flood control, water supply, water quality control and recreation." The site of the proposed dam, presently called Trumbull Pond Dam, is in the Town of Trumbull about one mile north of Daniel's Farm Road and about two miles north of the Merritt Parkway.

An appropriation was recently made by the Congress for the purpose of planning this project.

The Connecticut Highway Department is now completing plans for the relocation of State Highway Route 25. Several locations within the area covered by this report will be affected by the construction of this new highway. The project will include a relocation and crossing of Island Brook which is a tributary of the Pequonnock River, the construction of several new bridges, a change in the street pattern in the vicinity of North Avenue and Boston Avenue, and a crossing of the river near Pequonnock Avenue in Trumbull.


N
WEST BRANCH
EAST BRANCH
WATER CO. DIVERSION
MONROE
TRUMBULL
PROPOSED C.H.D. RELOCATION OF ROUTE 25
DANIELS FARM ROAD
BOOTH HILL BROOK
SHELTON
TRUMBULL
PROPOSED FEDERAL
TRUMBULL POND DAM
AND MULTIPURPOSE RESERVOIR
PINEWOOD LAKE
PEQUONNOCK
MERRITT PARKWAY
RIVER
TRUMBULL
BRIDGEPORT
OLD TOWN RD.
LAKE FOREST
ISLAND BROOK RESERVOIR AVE.
Beardsley Park
BUNNELL'S POND
North Ave.
Boston Av.
River St.
SCALE IN MILES
0
MILE
STUDY AREA
B-26

A-4. Review of Previous Studies and Reports

Following is a brief summary of previous studies and reports of problems within the study area.

(1) "Report on Erosion, Pequonnock River in Bridgeport, Connecticut," Dewey and Kropper, Engineers, January 9, 1956.
This report deals with the problem of bank protection in the vicinity of the Kennedy Center on Williams Street, adjoining Shopper's Fair. The Pequonnock River has a right angle bend at this location.

(2) "Flood Control Report of the Pequonnock River, Bridgeport, Connecticut," Dewey and Kropper, Engineers, July 1958.
The report describes investigations of channel improvements and bank protection along the river from Shopper's Fair to the Roosevelt Avenue Bridge. Recommended improvements consist of widening and deepening the channel, placing rock on the side slopes and constructing 320 feet of concrete retaining wall on the east bank of the river at the rear of properties fronting on Williams Street. The total estimated construction costs were $114,000.

(3) "Report on Flood Control and Allied Purposes - Pequonnock River Basin, Connecticut" by U.S. Army Engineer Division, New England Corps of Engineers, Waltham, Massachusetts dated May 14, 1965.
This report recommends construction of a multi-purpose reservoir and dam on the Pequonnock River in Trumbull for flood control, water supply, water quality control and recreation. The estimated first cost of the project is $5,000,000. A local protection plan below Bunnell's Pond was developed, but found to not warrant Federal participation at that time.

B. DESIGN FLOOD

General

There is only one gaging station in the study area, located at Daniel's m Road in Trumbull. Since this station has had only a short period of record it med appropriate to apply the "Flood-Flow Formula for Connecticut". This nula was developed by the U.S. Geological Survey under the authorship of L. Bigwood and M. P. Thomas and is based on records of 44 gaging stations Connecticut.

Mean Annual Flood

Calculation of the mean annual flood was based on the Flood-Flow Formula lch takes into account the drainage area, the weighted basin slope and the -off characteristics of the area under study. The mean annual flood has a re- rence of two and one third years and is equal to CAS where C is a basin co- icient, A is the effective drainage area and S is the weighted basin slope.

The following tabulation summarizes the data used to determine the mean nual flood (MAF) for (1) the natural basin and (2) for the basin as reduced by existence of the proposed Trumbull Pond Dam and Reservoir.

The mean annual flood flows were computed for four locations on the river cause of the influence of tributary brooks and the dissimilar characteristics of drainage areas. The four locations and the tabulation of data used to determine mean annual flows are as follows:

	LOCATION			
	#1 River Street	#2 Bunnell Pond Dam	#3 Old Town Rd.	#4 Booth Hill Brook *
tal Drainage Area - sq.mi.	28.3	24.1	23.0	17.5
atural Effective Area-sq.mi.	19.8	16.6	15.5	10.0
duced Effective Area-sq.mi.	12.6	9.3	8.2	3.6
ain Channel Slope - ft/mi.	29.5	32.0	32.5	36.8
ibutary Slope - ft/mi.	70.6	77.3	77.3	73.2
eighted Basin Slope - ft/mi.	50.1	54.6	54.9	55.0
oefficient	0.85	0.85	0.85	0.85
AF (natural watershed)cfs	842	770	725	468
AF (reduced by Dam) cfs	536	432	382	168
eduction in flow due to dam	36%	44%	47%	64%

*Upstream from confluence with Pequonnock River

B-3. Design Flood

The design flood used in this study is based on a ratio of eight times the mean annual flood as reduced by the proposed Trumbull Pond Dam. Such a flood is slightly greater than the flood of record for the area.

The following table lists the design discharges in cubic feet per second, used in this study for the four locations indicated above. The discharges for the October 1955 flood are also shown.

	LOCATION			
	#1	#2	#3	#4
October 1955 Flood	6400	5850	5500	4100*
Design Flood	4450	3600	3200	1500

*Estimated by the U.S. Geological Survey

C. WATER SURFACE PROFILES

C-1. October 1955 Flood Profile

The effect of a flood comparable to the October 1955 flood was tested on the channel as it presently exists. The river has remained substantially the same since 1955 except for one location where a major change has taken pla This is a short distance below North Avenue where, at Shopper's Fair, the river i confined in a large closed culvert over 800 feet long.

A location a short distance below River Street was taken as the starting point and a starting elevation of 8.0 feet above mean sea level was chosen. This was the highest elevation reached by the tide during the October 1955 flood.

In the southerly portion of the study area, from River Street to Bunnell's Pond, a water surface profile was computed for existing conditions by the standard step method. This is a trial-and -error method of calculating the water surface elevation at various cross sections of the stream by computing the losses between the sections. These losses include those due to friction, difference in velocity head, bends, transitions and bridges.

Profiles for the area between Bunnell's Pond Dam and Old Town Road (Beardsley Park) have been omitted for reasons given below under D-3.

In the reach of river in Trumbull, from Old Town Road to Daniel's Farm Roa the water surface profile was obtained by a flood vs. discharge relationship. The calculated depth and discharge for the design flood was applied to a parameter to determine the depth of flow for the October 1955 discharge.

C-2. Design Flood Profile

The water surface elevation of the design flood was computed at each cross section by the standard step method. In certain critical areas, which are discussed in detail in Section D, channel improvements were assumed. These improvements include widening and/ or deepening the waterway, improving side slopes and replacing existing bridges where necessary with those having greater waterway areas.

Backwater computations were started south of River Street at Elevation 8.0 which represents a tide 4.4 feet above mean high water water. Computations proceeded upstream to Bunnell's Pond Dam, making the assumptions relative to improvements of the channel which would permit the design flood to be contained within the channel without flooding or damaging the adjacent overbank areas.

Backwater computations were again started at Old Town Road with critical depth at points of control.

The profile of the flood discharge of the design flood and that of the October 1955 flood are shown on Drawings 2, 3 and 4. The design flood profile is predicated on the existence of Trumbull Pond Dam combined with improvements in the channel and replacement of certain structures.

D. SITE PROBLEMS AND RECOMMENDED IMPROVEMENTS

D-1. General

The study area has been divided into four sections, namely, River Street to Bunnell's Pond Dam, Bunnell's Pond Dam to Old Town Road (Beardsley Park), Old Town Road to Merritt Parkway and Merritt Parkway to Daniel's Farm Road.

Problems resulting from possible flooding are described for each section, the effect of the proposed Trumbull Pond Dam has been evaluated and plans for flood control are recommended where improvements have been deemed necessary.

D-2. River Street to Bunnell's Pond Dam

This reach of the river is about one mile in length and is subjected to tidal action. The channel slope is very flat, being only about four feet per mile. The river is crossed by bridges at River Street, Roosevelt Street and North Avenue.

A shopping center known as Shopper's Fair was constructed over the river in 1958 about 500 feet downstream of the North Avenue Bridge. The river is contained in a large culvert, about 820 feet in length, beneath the Shopper's Fair building and a parking area. The culvert is straight from the downstream end to an angle point about 80 feet from the upstream end. The long straight portion is actually composed by twin sections, each one having vertical concrete walls about 38 feet apart. The top consists of concrete slabs supported by reinforced concrete beams which span the two openings. In the short section of the culvert, above the angle, the top is supported by a number of concrete columns. The clear height of the culvert above the bed of the river averages about 11 feet.

The river takes almost a right angle bend at the downstream end of the culvert, subjecting the outer bank to considerable erosion. This area was the subject of the study made by Dewey and Kropper, referred to in A-4.

Island Brook joins Pequonnock River about 1000 feet north of River Street. This tributary drains an area of about 3.1 square miles. Midway up the stream is Lake Forest, a lake with a large surface area which tends to lessen the effects of a rather "flashy" brook. A short distance west of North Avenue the brook flows into Seely Pond. This pond will be filled in during construction of the new Route 25. Also, as part of the roadway relocation project, Island Brook will be contained in twin culverts, each 6 feet by 12 feet and extending under the new highway and North Avenue to discharge at a point about 100 feet east of North Avenue.

Properties in the vicinity of this section of the study area have suffered considerable damage resulting from major floods. Bunnell's Pond Dam failed during the "Bridgeport Flood" of July, 1905 partly due to the blocking of the spillway by an accumulation of debris. Another dam farther downstream also failed and the North Avenue bridge collapsed. Damage during the October 1955 flood, which was accompanied by unusually high tides, was due primarily to flooding rather than to the failure of structures. North Avenue was inundated by about 6 feet of water and Island Brook Avenue was flooded by about two feet.

As another part of the Route 25 project the State Highway Department will construct a new roadway extending northerly from the intersection of North and Boston Avenues to Carson Street, thence to Reservoir Avenue. This so-called connection to Reservoir Avenue will require the construction of a new bridge over Pequonnock River, It is expected that the waterway under this bridge will be large enough to carry the design discharge.

Improvements in the entire reach of the river, from River Street almost to Bunnell's Pond Dam, are necessary. The most critical area is upstream of Shopper's Fair where the channel and North Avenue bridge are incapable of containing flood flows, particularly if such flows coincide with unusually high tides.

Below River Street the tide reached a level of 8.0 feet above mean sea level during the October 1955 flood. Even higher tides have been recorded, namely, Elevation 9.5 in September, 1938 and Elevation 9.3 in September, 1954.

North Avenue Bridge has two 20 foot spans, the waterway being about 4 feet high. The top of the waterway opening is at Elevation 6.6 and the bridge deck is Elevation 11. The maximum flow that can be carried under the bridge is about 2000 cfs with a head of 4 feet on the upstream side and assuming that there are no downstream restrictions that could cause a backwater condition. A recurrence of a flood of the magnitude of the one of October 1955 would submerge the highway at the bridge by about 6 feet.

The Trumbull Pond Reservoir will be of considerable value in this area since the peak discharge of a major flood would be reduced by about 40 per cent. The impounded flood waters would be released slowly through a conduit in the dam. In spite of this, however, a major flood coincident with abnormal high tide could cover North Avenue with 2 or 3 feet of water.

Improvements in the Island Brook channel, in the reach between its confluence with Pequonnock River and the proposed twin culvert, are also indicated.

Recommended Flood Control Plan. It is recommended that critical sections of the river be improved and that the North Avenue bridge be replaced with a new structure. Improvements of the Island Brook channel are also suggested. The recommended improvements are shown in plan and profile on Drawing No. 2 and cross sections are on Drawing No. 5.

From River Street to Island Brook the river would be widened, bringing th bottom width to about 52 feet with side slopes 1 on 1.5. At Sections E and F, opposite the outdoor movie, the widening would cut into the east bank about 15 feet and into the west bank about 10 feet. The existing channel has sufficient width at its confluence with Island Brook but the deposition in the bottom of the channel should be removed to provide a smoother profile.

North of Roosevelt Street the proposal is to widen the west bank by cutting it back from 7 to 16 feet, thus providing a minimum bottom channel width of 50 feet. Stone rip rap would be placed on the slope of the east bank from the outlet of the culvert under Shopper's Fair downstream 250 feet to prevent scouring of the bank.

It is recommended that the North Avenue bridge be replaced by one having a span of 70 feet and a clear waterway 9 feet in height. A center pier would decrease the depth of the carrying beams, thus keeping the elevation of the bridge floor as low as possible. This is necessary in order to avoid excessive regrading of the approaches to the bridge and at nearby street intersections.

The channel from North Avenue southerly to Shopper's Fair should be made deeper and wider. A bottom width of 50 feet and side slopes of 1 on 1.5 are recommended. It will be necessary to construct a low wall at the top of the banks in order to contain the design flood flow, the present surface being about one foot lower in elevation than the computed water surface elevation.

The culvert under Shopper's Fair is capable of handling the reduced design flood flow and therefore no revisions of the culvert are recommended. Under design flood conditions there would be an underclearance of about one foot.

Between North Avenue and Bunnell's Pond Dam the recommended improvements include re-alignment and deepening the channel and construction of earth embankments on each side of the channel. It is also suggested that a log chain be stretched across the lower end of Bunnell's Pond to snare floating debris. Under design flood conditions the recommended North Avenue bridge and the bridge on the proposed Reservoir Avenue Connector will have submerged openings. It is therefore essential that these openings be kept clear of debris.

As stated above, Island Brook will flow under North Avenue in a box culvert. The stream will then be contained within an open concrete channel for a short distance. It is recommended that the remainder of the brook be improved by extending the open concrete channel about 250 feet, by widening and deepening the channel and by trimming the side slopes.

Our calculations indicate that both River Street bridge and Roosevelt Avenue bridge have sufficient waterway openings to carry the design flood.

D-3. Bunnell's Pond Dam to Old Town Road

Beardsley Park, of which Bunnell's Pond is a part, covers this area. Since flood damage would be relatively minor no recommendations are made except for the one mentioned above, namely, to install a log chain at a convenient location near the dam. Such a device might be made of styrofoam or some other suitable material and perhaps could be installed at an angle that would tend to encourage the currents to deflect the debris toward the shore.

D-4. Old Town Road to Merritt Parkway

This reach of the river is almost three quarters of a mile in length and has a very flat slope, about 7 feet per mile. Just above Old Town Road the river flows through a short stretch of rather steep rocky terrain. For the most part, however, the flow is through a narrow flood plain. A number of residential streets "dead end" near the east bank of the flood plain.

A low section or "saddle" exists in the west bank of the flood plain about 600 feet north of Old Town Road and 300 feet west of the river. Under certain flood conditions water could flow through the saddle and flood a section of Old Town Road east of Trumbull Road.

The design flood discharge as well as one of the magnitude of the October 1955 flood would inundate a considerable area. Little damage would result, however, because the area that would be flooded is uninhabited. As indicated on Drawing No. 3 the first floors of the houses nearest the flood plain line are well above the design flood profile line.

Recommended Flood Control Plan. The only physical improvement recommended is the construction of an earth embankment or dike, about 300 feet in length, across the saddle described above. This would restrict the design flood discharge to the existing waterway and flood plain, preventing overbank flow across Old Town Road.

It is also recommended that flood plain zoning or stream encroachment lines be established not only to regulate the development of the flood plain but also to preserve the capacity of the existing waterway area.

D-5 Merritt Parkway to Daniel's Farm Road

This reach of the Pequonnock River is approximately 1.5 miles in length. Booth Hill Brook, with a drainage area of 5.5 square miles, joins the river 300 feet north of White Plains Road.

A short distance upstream of the confluence of the two streams Booth Hill Brook widens into an artificial pond created by a former gravel removal operation. A residential sub-division has been developed easterly of the pond and a recreation area known as Twin Brooks Park is west of the pond. Access to the park is from White Plains Road by way of Brock Street.

From Merritt Parkway to the northerly limit of Twin Brooks Park the river bed has a very flat slope. North of the park the slope is somewhat steeper.

The river has an uncontrolled drainage area of 3.6 square miles between the Booth Hill Brook tributary and the site of the proposed Trumbull Pond Dam. The dam and the impounded reservoir will control about 13.9 square miles of drainage area.

A flood comparable to the October 1955 flood would spread to the intersection of White Plains Road and Brock Street and would cover the low point of Brock Street, midway between White Plains Road and the river, with about 4 feet of water. There would also be some flooding of basements in this vicinity and also in one house at the end of Larkspur Drive on the east side of the river.

The proposed relocated Route 25 crosses the river near the end of Pequonnock Road. One dwelling on the west bank of the river would be exposed to flood storms but this dwelling will become isolated by the new highway construction and will undoubtedly be abandoned.

At Daniel's Farm Road the bridge over the river can accomodate the design flood flow. However, a low point in the roadway about 150 feet west of the bridge would be flooded to a one foot depth under design flood conditions.

It appears that a flood of the magnitude of the design flood would cause no appreciable damage, except as noted, in any other location within the reach of river between the Merritt Parkway and Daniel's Farm Road. It is also expected that there will be no flooding of structures between Daniel's Farm Road and the site of the proposed Trumbull Pond Dam.

Recommended Flood Control Plan. Only two locations within the reach of the river from the Merritt Parkway to the site of the proposed dam have required serious study.

At the White Plains Road - Brock Street area a local flood control plan was considered but found to be unwarranted because of the relatively minor benefits compared with the costs. About 1000 feet of diking would be required and some method of discharging rain water that collected within the dikes would be necessary.

At Daniel's Farm Road it is recommended that the low point in the roadway west of the bridge be raised 2 or 3 feet. This would not only tend to confine flood flows to the river channel but it would also improve the approach to White Plains Road (Route 127) which is presently quite steep.

It is also recommended that flood plain zoning or stream encroachment lines be established so that the areas potentially exposed to flooding might be regulated.

COST ESTIMATE

AREA 1 RIVER STREET to BUNNELL'S POND

Earth excavation	60,000 c.y.	@ $ 1.75	=	$ 105,000.
Embankment (1000 ft)	8,000 c.y.	@ 3.00	=	24,000.
Flood walls	1,000 lin.ft.	@ 35.00	=	35,000.
Island Brook conc. channel	250 lin.ft.	@ 160.00	=	40,000.
Debris catch	400 lin.ft.	@ lump sum	=	4,000.
Stone rip-rap	600 c.y.	@ 10.00	=	6,000.
New bridge-North Ave. and approaches		@ lump sum	=	150,000.

AREA 2 OLD TOWN ROAD to MERRITT PARKWAY

Embankment	1,200 c.y.	@ 3.00	=	3,600.

AREA 3 DANIEL'S FARM ROAD

Raise roadway (3') 200 lin. ft.		@ 25.00	=	5,000.
				37[illegible],600.
Engineering and contingencies 20%			=	74,400.
				$ 447,000.

Bunnels Pond Dam
Pequonnock River
Beardsley Park
Bridgeport, Connecticut

Jan 30, 74

ESTABLISHED 1887

S. E. MINOR & CO., INC.
CIVIL ENGINEERS
161 MASON STREET
GREENWICH, CONNECTICUT 06830

January 30, 1974

State of Connecticut
Department of Environmental Protection
State Office Building
Hartford, Connecticut 06115

Attention: Mr. Victor F. Galgowski
Superintendent of Dam Maintenance
Water and Related Resources

Re: Bunnells Pond Dam
Pequonnock River
Beardsley Park
Bridgeport, Connecticut

Dear Mr. Galgowski:

In accordance with your request of January 16, this office has conducted an inspection of the subject dam located on the Pequonnock River in Beardsley Park. Prior to visiting the dam, we went to the City Engineer's office in Bridgeport in order to obtain any record drawings or information that they might have available that might indicate the construction of the dam. Nothing at all was available in their office. We, therefore, examined the dam to the best of our ability and made certain assumptions as to the depth, thickness, and mass of the dam. These assumptions were based on our past experience with dams similar in shape and size to Bunnels Pond Dam.

We ran through calculations to determine the stability of the dam and specifically checked the overturning as well as sliding factors. Copies of these computations are attached and comprise part of this report.

In addition, we are enclosing three copies of our drawing entitled, "Field Sketch, Bunnels Pond Dam, Beardsley Park, Bridgeport, Connecticut" dated January 23, 1974. As may be seen from said sketch, the spillway elevation is approximately 6 feet, 6 inches below the top of the earthen embankment on either side of the spillway. Based on the tremendous capacity of the spillway and the large area of Bunnels Pond, it is our considered opinion that overtopping would be almost impossible.

After examining the structure and completing the aforementioned analysis, it is our professional opinion that the Bunnels Pond Dam is structurally sound and stable. We do recommend, however, that certain steps be taken which would be considered normal maintenance. Said steps are as follows:

1. Pointing of cracks in the west wing wall.

2. Pointing of joints in the stone masonry retaining wall, downstream of the dam.

3. Resurfacing the spillway, using an epoxy cement to bond the mortar to the existing concrete.

4. Placing rip rap on the slopes of the adjoining embankments along the lake shore.

5. Clearing the apron of fallen trees and accumulated organic matter and resetting any stones that have become loose.

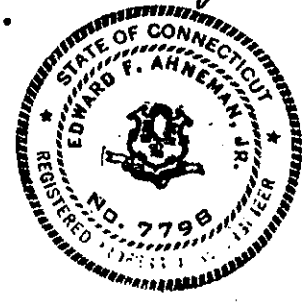
6. Repairing the concrete deck and placing a removable cover over the vertical shaftway in the west wing wall. Presumably, a gate and hoisting mechanism were removed, leaving a deep hole potentailly dangerous to anyone walking in the vicinity. In addition, the cover would keep debris from falling into the shaftway and prevent blocking the flow of water through the "diversion tunnel" in the wing wall. The latter, by the way, appeared to be in good condition structurally. Flow was good.

Should you have any questions regarding this report or desire clarification or further investigation, please contact me.

Very truly yours,

S. E. MINOR & CO., INC.

Edward F. Ahneman, Jr.
Chief Engineer



EFA:lb
Enclosures

B-64

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING • HARTFORD, CONNECTICUT 06115

6 February 1974

Mr. Raymond Mathews
Acting Director of Parks & Recreation
Department of Parks & Recreation
45 Lyon Terrace
Bridgeport, Connecticut 06604

Re: Bunnels Pond Dam
Bridgeport

Dear Mr. Mathews:

The subject dam was recently inspected by one of the engineering consulting firms retained by this department. We are pleased to report that it is their opinion that this dam is structurally sound and stable. They do recommend, however, that the following maintenance steps be taken:

1. Pointing of cracks in the west wing wall.

2. Pointing of joints in the stone masonry retaining wall, downstream of the dam.

3. Resurfacing the spillway, using an epoxy cement to bond the mortar to the existing concrete.

4. Placing rip rap on the slopes of the adjoining embankments along the lake shore.

5. Clearing the apron of falling trees and accumulated debris and resetting loose stones.

6. Repairing the concrete deck and placing a cover over the vertical shaftway in the west wing wall. This would eliminate the danger of someone falling into the hole and also keep debris from falling into the shaftway and possibly blocking the flow of water through the "diversion tunnel" in the wing wall.

Although these repairs are not now essential for the safety of the dam, in order to avoid further deterioration they should be carried out. From the standpoint of good maintenance and appearance this work is warranted.

B-69

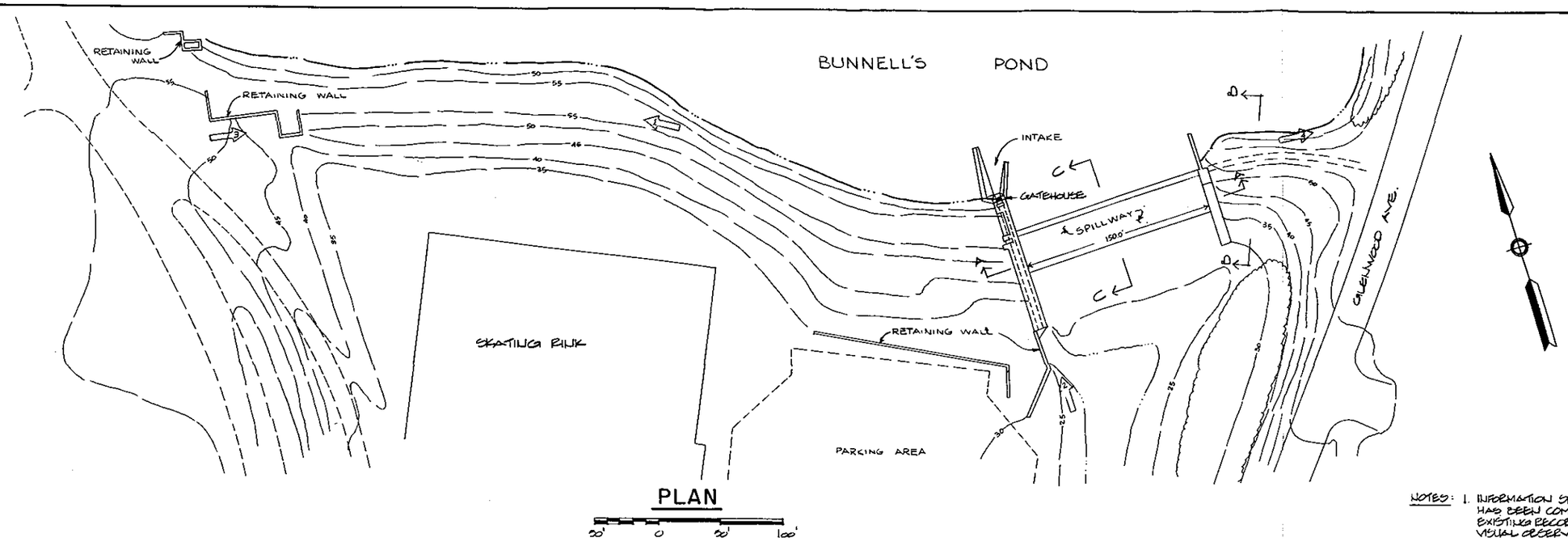
Should you have any questions regarding this report, please contact me at 566-5506.

Very truly yours,

Victor F. Galgowski
Supt. of Dam Maintenance
Water & Related Resources

VFG:ljg

B-70



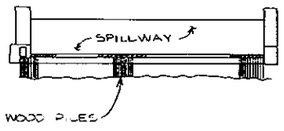
PLAN

50' 0 50' 100'

NOTES:
1. INFORMATION SHOWN HEREIN HAS BEEN COMPILED FROM EXISTING RECORD DATA AND VISUAL OBSERVATIONS.
2. ALL ELEVATIONS SHOWN ARE BRIDGEPORT CITY DATUM (BCD) WHICH IS 10.5' BELOW U.S.G.S. DATUM (MSL) (MSL = BCD - 10.5')

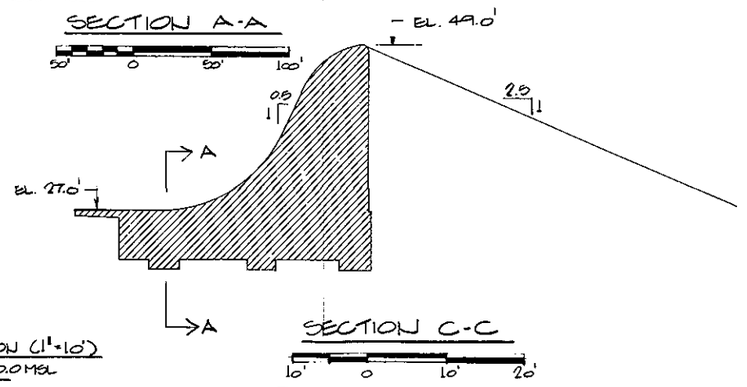
⊏ ▷ PHOTO NUMBER AND DIRECTION

DATUM CONVERSION (1" = 50')
ELEV 23.5 BCD = 10.0 MSL
MSL 0.0 — 10' — 10.5'
BCD 0.0



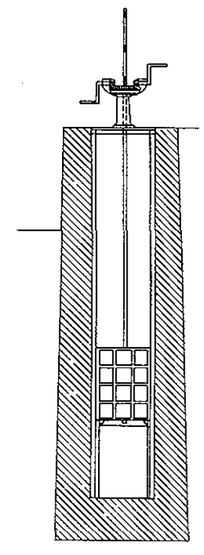
SECTION A-A

50' 0 50' 100'



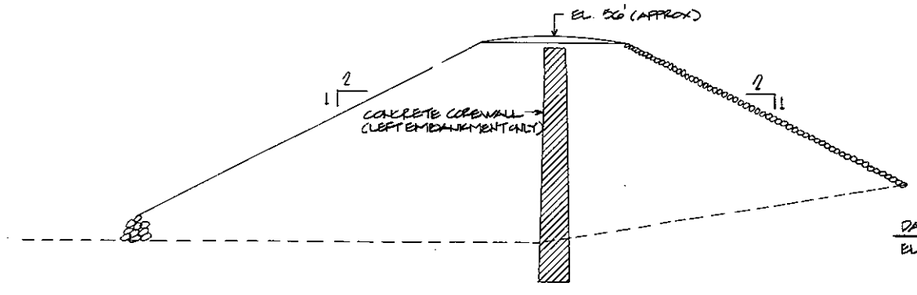
SECTION C-C

10' 0 10' 20'



GATE HOUSE

PROFILE



SECTION B-B

10 0 10 20

DATUM CONVERSION (1" = 10')
ELEV 23.5 BCD = 10.0 MSL
10'
MSL 0.0
23.5'
BCD 0.0

SECTIONS

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

BUNNELLS POND DAM

PEQUONNOCK RIVER — BRIDGEPORT, CONNECTICUT

DWN. BY	CKD. BY	APP. BY	SCALE AS NOTED
JM	CAG	PWH	DATE 6/7/78 — PAGE B-85

APPENDIX

SECTION C: DETAIL PHOTOGRAPHS

PHOTO NO.1 - General view of crest of dam to right of spillway

PHOTO NO.2 - Right abutment and low level outlet, and spillway.

PHOTO NO.3 - Retaining wall downstream to right end of dam.

PHOTO NO.4 - Riprap and unprotected reservoir embankment to left of spillway.

APPENDIX

SECTION D: HYDRAULIC/HYDROLOGIC COMPUTATIONS

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

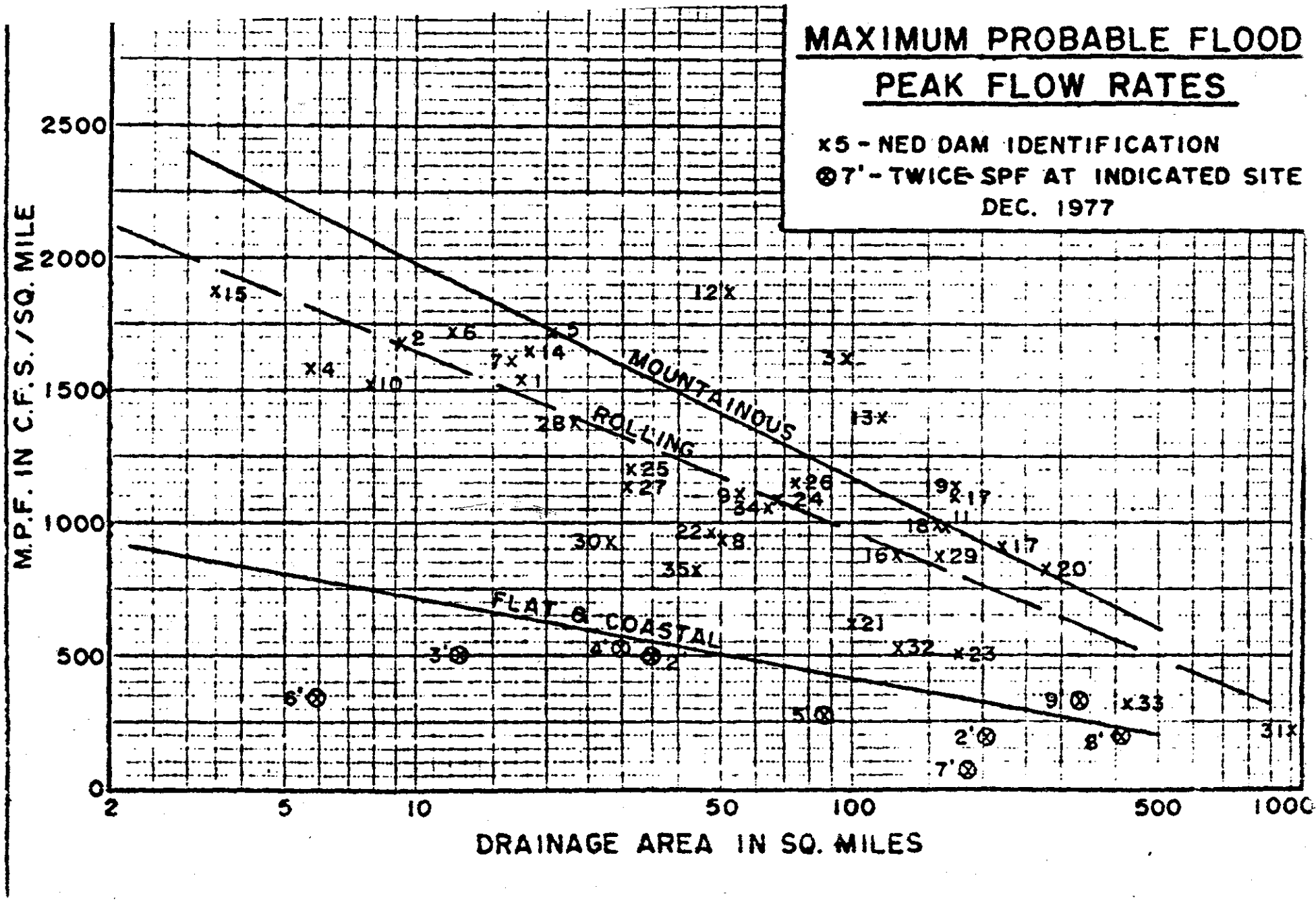
March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

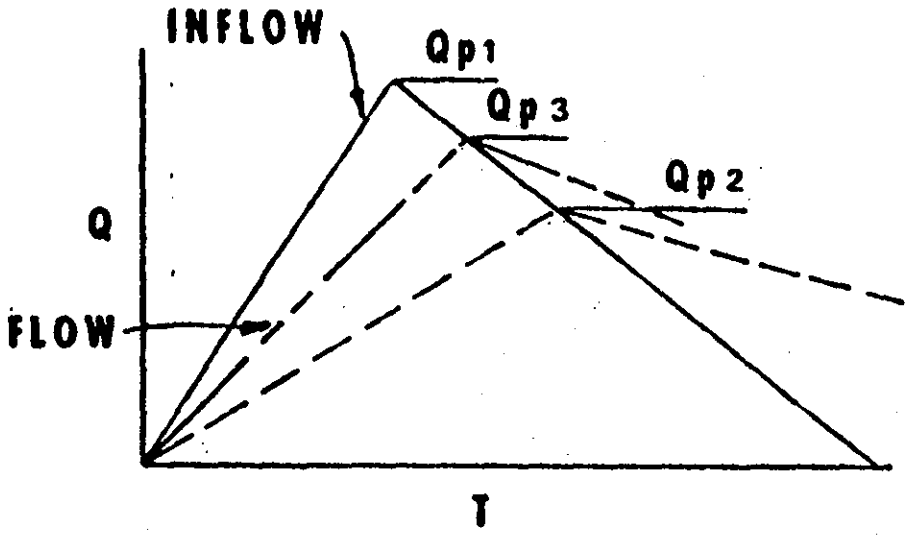
	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS BASED ON TWICE THE STANDARD PROJECT FLOOD (Flat and Coastal Areas)

	River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1.	Pawtuxet River	19,000	200	190
2.	Mill River (R.I.)	8,500	34	500
3.	Peters River (R.I.)	3,200	13	490
4.	Kettle Brook	8,000	30	530
5.	Sudbury River.	11,700	86	270
6.	Indian Brook (Hopk.)	1,000	5.9	340
7.	Charles River.	6,000	184	65
8.	Blackstone River.	43,000	416	200
9.	Quinebaug River	55,000	331	330


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SITE
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
2500
2000
1500
1000
500
0
2
5
10
50
100
500
1000
DRAINAGE AREA IN SQ. MILES
MOUNTAINOUS
ROLLING
FLAT & COASTAL
x15
x4
x10
x2
x6
x14
x1
12x
3x
13x
28x
x25
x27
9x
34x
x26
x24
9x
x17
11
18x
x17
x20
16x
x29
30x
22x
x8
35x
x21
x32
x23
x33
31x
3'⊗
4'⊗
2
6'⊗
5⊗
9⊗
2'⊗
8'⊗
7'⊗

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp1".

b. Determine Volume of Surcharge (STOR1) In Inches of Runoff.

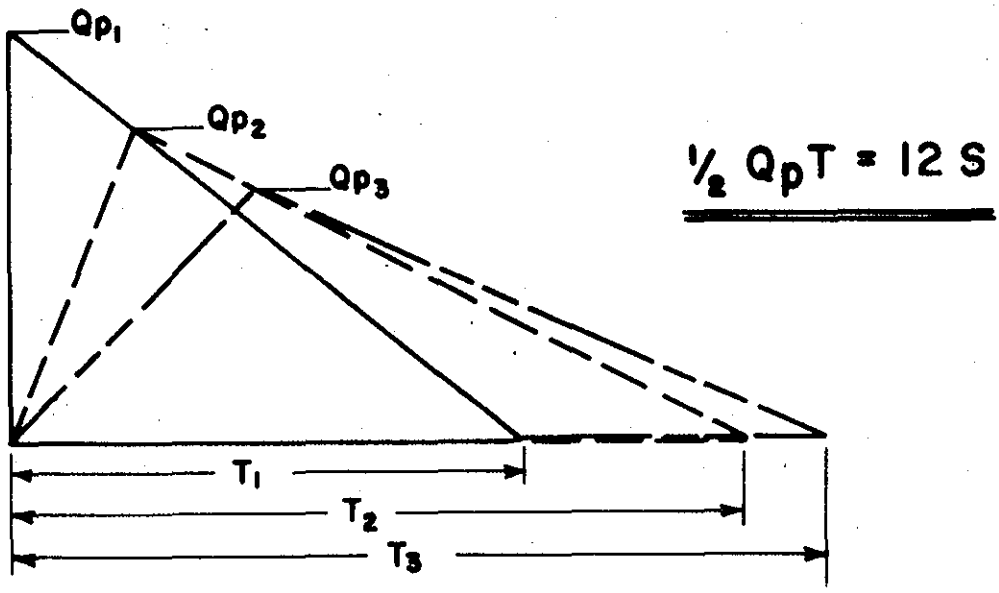
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefor

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "STOR2" To Pass "Qp2"

b. Average "STOR1" and "STOR2" and Determine Average Surcharge and Resulting Peak Outflow "Qp3".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{\frac{3}{2}}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1 \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 \left(1 - \frac{V_{avg}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND EAST BRIDGEPORT, CONNECTICUT

(1) MAXIMUM PROBABLE FLOOD - PEAK FLOW RATE

(a) WATERSHED CLASSIFIED AS "ROLLING" TYPE
THE MPF GUIDE CURVES FURNISHED BY THE ACE, NEW ENGLAND DIV. OFFICE ARE USED FOR THE DETERMINATION OF MPF.

(b) WATERSHED AREA:
DA = 24.6 SQ. MI (CLARENCE BLAIR ASSOC. JULY 7, 65
CE MEASURED DA = 25.2 SQ. MI
* USE DA = 25.0 SQ. MI

(c) FROM GUIDE CURVE
MPF ≅ 1400 CFS / SQ. MI

(d) MPF = PEAK INFLOW

$$Q = 1,400 \times 25 = 35,000 \text{ CFS}$$

* NOTE: THE TOTAL DA OF 25 SQ. MI WILL BE USED FOR THIS COMPUTATION ALTHOUGH WATER FROM 4.3 SQ. MI OF THIS WATERSHED IN THE WEST BRANCH OF THE POQUONNOCK (PREVIOUS: POQUONOCK) RIVER IS DIVERTED TO EASTERN RESERVOIR BY THE BRIDGEPORT HYDRAULIC CO. NEAR RTE 25 AT STEPNEY (SEE C. BLAIR ASSOC. REPORT ON BUNNELL'S POND DAM JULY 7, 1965)

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND EAST BRIDGEPORT, CONN.

(2) SPILLWAY DESIGN FLOOD (SDF)

(a) CLASSIFICATION OF DAM ACCORDING TO ACE RECOMMENDED GUIDELINES.

(i) SIZE (IMPOUNDMENT)

STORAGE (MAX.) ① = ± 800 Ac-ft (SMALL)

HEIGHT (STRUCT) ② = ± 33 ft (SMALL)

THEREFORE, THE DAM IS CLASSIFIED AS "SMALL" IN SIZE.

(ii) HAZARD POTENTIAL:

THE DAM IS LOCATED DIRECTLY U/S OF A SKATING RINK AND OF URBAN DEVELOPED AREAS IN BRIDGEPORT THEREFORE, THE HAZARD POTENTIAL IS RATED "HIGH"

(iii) SDF.

ACCORDING TO ACE RECOMMENDED GUIDELINES FOR A DAM OF SMALL SIZE AND HIGH HAZARD POTENTIAL, SDF SHALL BE FROM $\frac{1}{2}$ PMF TO PMF

ASSUME SDF = PMF = 30,000 CFS

NOTE: ① U.S. INVENTORY OF DAMS, 3/10/78 p. 9. - MAX. STORAGE = 734 Ac-ft.
CONN. WATER RESOURCES BULL. No 17, 1970. p. 13. TOTAL STORAGE AT FLOWLINE (ELEV. 34 MSL) = 147 MG ≅ 451 Ac-ft.
AREA AT FLOW LINE: CONN. WATER RESOURCES BULL NO 17 = 42 Ac.
CE MEASURED ≅ 47 Ac. NRC INVENTORY ≅ 44 Ac.
(USE A = 47 Ac) (CONTINUE ON p. 3 AND p. 4)

HYDROLOGIC/ HYDRAULIC INSPECTION

BUNNELL'S POND EAST BRIDGEPORT, CONN

NOTE ① (CONT'D)

FREEBOARD FROM CREST OF SPILLWAY (ELEV *35.8' MSL) TO TOP OF DAM (ELEV.* 43.3' MSL) = 7.5' (SEE BRIDGEPORT HYDRAULIC CO. DWGS). IT SHOULD BE NOTED, THAT A SECTION ±50' LONG, OF THE EMBANKMENT, IS DEPRESSED TO AN ELEV. 6.6' ABOVE THE SPILLWAY (SEE C. BLAIR ASSOC. JULY 1978 REPORT) HOWEVER, FOR THIS COMPUTATION, THE DAM WILL BE ASSUMED REPAIRED TO FULL HEIGHT WITH SPILLWAY FREEBOARD OF 7.5'. THEREFORE,

ADDITIONAL STORAGE TO TOP OF DAM 47 x 7.5 ≈ 350 Ac-ft

∴ MAX. STORAGE ≈ 900 Ac-ft.

② FROM BRIDGEPORT HYDRAULIC CO, "BUNNELL'S LOWER POND DAM" DWGS AND TOPOGRAPHIC MAP BY LOCKWOOD, KESSLER & BARLETT, INC, DATED JUNE, 1972.

STREAM BED ± ELEV * 10.5' MSL TO TOP OF DAM ± ELEV * 43.3' MSL. HEIGHT ≈ 32.8', SAY 33'

*NOTE: ELEVATIONS ON BRIDGEPORT HYDRAULIC CO (BHC) DWGS ARE ON BHC DATUM.

MSL (USCGS DATUM) ≡ BHC + 3.80'

LOCKWOOD, KESSLER & BARLETT, INC. TOPOGRAPHIC MAP ELEVATIONS ARE ON THE CITY OF BRIDGEPORT (CB) DATUM.

MSL (USCGS DATUM) ≡ CB − 13.51'

THE ELEVATIONS SHOWN IN THESE MAPS CORRELATE REASONABLY WELL WHEN TRANSLATED TO US CGS DATUM

ie. SPILLWAY CREST ELEV (FLOW LINE OR SURFACE ELEV.) ≡ 35.8' MSL (BHC DWG) VS ± 36' MSL (TOPO. MAP).

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND EAST BRIDGEPORT, CONN

* NOTE (cont'd)

THEY ARE HOWEVER ± 2' HIGHER THAN ELEV. 34' MSL SHOWN AS W.S. ELEV. AT THE USGS BRIDGEPORT QUADRANGLE SHEET AND THE (USGS) CONN. WATER RESOURCES BULLETIN No 17, 1970.

FOR THIS COMPUTATION, ELEV. 35.8' HAS BEEN TAKEN AS THE MSL ELEV. OF THE SPILLWAY CREST.

(3) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES.

(a) PEAK INFLOW (SDF = MPF) (SEE p. 2)

$Q_{P_1} = 35,000$ CFS

(b) SURCHARGE HEIGHT TO PASS Q_{P_1}

(i) ESTIMATE SURCHARGE ABOVE SPILLWAY CREST

FROM BRIDGEPORT HYDRAULIC Co., BUNNELL'S POND DWGS.

SPILLWAY LENGTH, $L = 1\text{<}0'$; $C \approx 3.9$ (ASSUMED)

$CL \approx \text{<}90$

$\therefore Q = \text{<}90\, H^{3/2}$

@ $Q_{P_1} = 35,000$ CFS

$H_1 \approx 15.2' > 7.5'$

FREEBOARD OF SPILLWAY CREST TO TOP OF DAM IS 7.5', THEREFORE, THE DAM IS OVERTOPPED. SPILLWAY CAPACITY @ $H = 7.5'$, $Q \approx 12,000$ CFS

D-10

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND EAST BRIDGEPORT, CONN.

(3) (CONT'D) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES:

NOTE: THIS ESTIMATION OF THE EFFECT OF SURCHARGE STORAGE ON MPS IS MADE IN ACCORDANCE TO PROCEDURES OUTLINED IN ACE - NENG. DIV. GUIDELINE SHEETS.

(c) COMPUTE SURCHARGE HEIGHT H_1 ft

SURCHARGE HEIGHT ABOVE TOP OF DAM = $H_1 - 7.5$

LENGTH OF EMBANKMENT SECTION (EAST OF SPILLWAY) = ± 140'

LENGTH OF EMBANKMENT SECTION (WEST OF SPILLWAY) = ± 710'

ASSUME $C \cong 2.70$

$CL = 2.7 \times (140 + 710) \cong 2300$

$\therefore Q = 2300 (H_1 - 7.5)^{3/2}$

A BERM ON EASTERLY END OF THE EMBANKMENT RISES APPROXIMATELY 5 FT. IN A DISTANCE OF ± 80 FT.

HYDROLOGIC/ HYDRAULIC INSPECTION

BUNNELL'S POND, BRIDGEPORT. CONN

(3) (CONT'D)- EFFECT OF SURCHARGE VOL. ON MPF'S

(C) COMPUTE TRUE SURCHARGE HEIGHT. H_1 FT.

ASSUME EQUIVALENT LENGTH OF SPILLAGE OVER BERM AT THE EASTERLY END $= \frac{2}{3}(H_1 - 7.5) \times (\frac{80}{5})$

ASSUME $C \approx 2.60$

$\therefore Q \approx 28 (H_1 - 7.5)^{5/2}$

SPILLAGE OVER THE WESTERLY END OF THE EMBANKMENT HAS A HORIZONTALLY-TOPPED SECTION WITH A DISTANCE OF ±260 FT. AND A BERM WHICH RISES 5 FT IN A DISTANCE OF ±250 FT.

ASSUME $C \approx 2.60$

FOR HORIZONTAL SECTION, $CL \approx 2.6 (260) \approx 680$

$Q \approx 680 (H_1 - 7.5)^{3/2}$

ASSUME EQUIVALENT LENGTH OF SPILLAGE OVER BERM $= 2/3 \times (H_1 - 7.5) \times (\frac{250}{5})$, $C \approx 2.60$

$\therefore$ FOR SPILLAGE OVER THE BEAM.

$Q \approx 87 (H_1 - 7.5)^{5/2}$

$\therefore$ TOTAL DISCHARGE WITH SURCHARGE H_1 ABOVE THE SPILLWAY CREST:

$Q \approx 590 H_1^{3/2} + (2300 + 680)(H_1 - 7.5)^{3/2} + (2818)(H_1 - 7.5)^{5/2}$

HEREFORE: $Q \approx 590 H_1^{3/2} + 3000 (H_1 - 7.5)^{3/2} + 120 (H_1 - 7.5)^{5/2}$

D-12

ahn Engineers Inc. **Consulting Engineers**

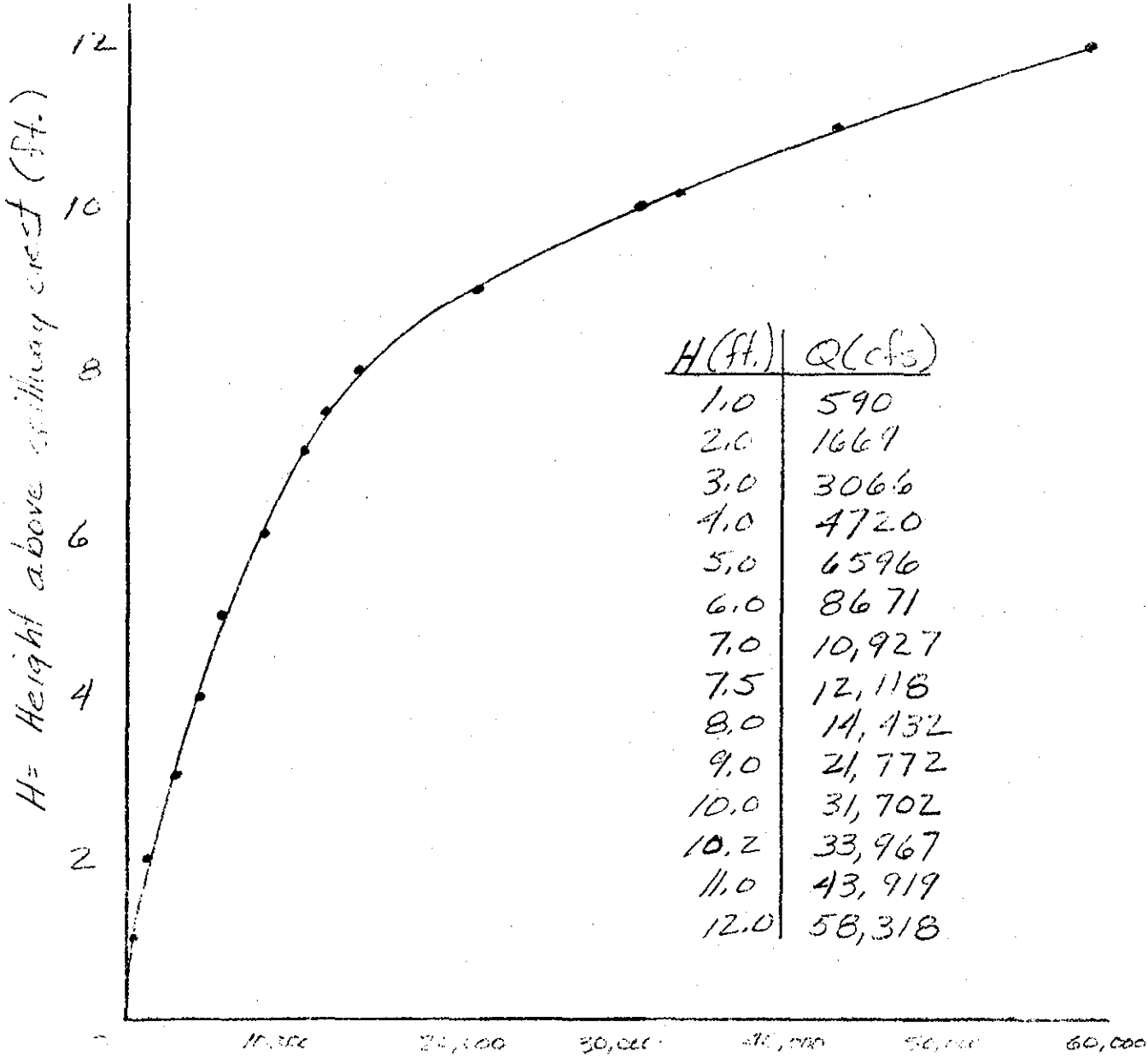
ct BUNNELLS POND DAM — Sheet 1 of 1

uted By HWICKS — Checked By _____ — Date 9/5/75

Book Ref. _____ — Other Refs. _____ — Revisions _____

SPILLWAY RATING CURVE

$Q = 3.1 \cdot 10 H^{3/2} + 3.1 \cdot 20 (H - 7.5)^{3/2} + 3.1 \cdot 20 (H - 7.5)^{3/2}$



H(ft.)	Q(cfs)
1.0	590
2.0	1669
3.0	3066
4.0	4720
5.0	6596
6.0	8671
7.0	10,927
7.5	12,116
8.0	14,432
9.0	21,772
10.0	31,702
10.2	33,967
11.0	43,919
12.0	58,318

Q= Flow (cfs)

HYDROLOGIC / HYDRAULIC INSPECTION
BUNNELL'S POND, BRIDGEPORT, CONN

(3) (CONT'D) - EFFECT OF SURCHARGE VOL. ON MPF's

(c) COMPUTE THE SURCHARGE HEIGHT H_1, FT.

∴ FOR $Q_{P_1} = 35,000$ CFS
$H_1 \cong 10.3'$

THE TOP OF THE EMBANKMENT IS OVERTOPPED WITH A HEAD OF APPROXIMATELY ± 2.8' @ Q = 35,000 CFS

(d) VOLUME OF SURCHARGE

ASSUME NORMAL POOL ELEVATION TO BE 0.5 FT. ABOVE THE SPILLWAY CREST

AREA OF POOL = 47 AC. (SEE p. 2)

FOR $Q_{P_1} = 35,000$ CFS AND $H_1 \cong 10.3'$

VOL. OF SURCHARGE =

$47 \times (10.3 - 0.5) = 460$ AC-FT.

D.A. = 25.80 MI

$S_1 = \frac{460}{25 \times 13.3} = 0.35''$

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND BRIDGEPORT, CONN.

(3) (CONT'd) - EFFECT OF SURCHARGE VOL. ON MPF'S

(e) PEAK OUTFLOW FOR SURCHARGE S_1

(SEE GUIDELINES FOR ASSUMING A TRIANGULAR HYDROGRAPH AND MPF RUNOFF IN NEW ENGLAND = ± 19")

$$Qp_2 = Qp_1 \left(1 - \frac{S_1}{19}\right)$$

$$\therefore Qp_2 \approx 35{,}000 \left(1 - \frac{0.35}{19}\right)$$

$$\approx 34{,}000 \text{ CFS}$$

FOR $Qp_2 \approx 34{,}000$ CFS

$H_2 \approx 10.2'$

$S_2 = 0.34''$ $\therefore S_{AVG} \approx 0.34''$

(f) RESULTING ~~PEAK~~ OUTFLOW

$Qp_3 \approx 34{,}000$ CFS

$H_3 \approx 10.2'$

(g) SUMMARY:

PEAK INFLOW: $Qp_1 = MPF = 35{,}000$ CFS

PEAK OUTFLOW $Qp_3 = 34{,}000$ CFS

AVERAGE SURCHARGE HEIGHT = 10.2' OVER THE SPILLWAY CREST, (OR ± 2.7' ABOVE THE TOP OF THE EMBANKMENT (MIL. ELEV ± 46.0' MSL)

D-11

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND, EAST BRIDGEPORT, CONN.

DOWNSTREAM FAILURE HAZARD

(1) ESTIMATE OF D/S DAM FAILURE HAZARD.
(SEE D. SHEN COMPS. 5/19/78)

(i) MAX. STORAGE CAPACITY = 800 Ac-ft.

(ii) HEIGHT OF DAM ABOVE SPILLWAY = 7.5 ft

(iii) AREA AT FLOWLINE = 47 Ac.

(iv) HEIGHT OF MAXIMUM POOL = 33'

(v) ESTIMATE VOLUME OF STORAGE AT TIME OF FAILURE

TO A SURCHARGE HEIGHT OF ± 2.7' OVER THE TOP OF THE DAM (ELEV. ± 46.0' MSL) OR. 10.2' ABOVE THE SPILLWAY CREST.

$\therefore S \cong 800 + 47(2.7) \cong \underline{930 \text{ Ac-ft}}$

$\frac{S}{2} = \underline{465 \text{ Ac-ft}}$

HYDROLOGIC / HYDRAULIC INSPECTION

BUNNELL'S POND, EAST BRIDGEPORT, CONN.

DOWNSTREAM FAILURE HAZARD

(1) ESTIMATE OF DOWNSTREAM DAM FAILURE HAZARD

(b) PEAK FAILURE OUTFLOW (Q_{p_1})

(i) BREACH WIDTH:

FROM THE TOPOGRAPHIC MAP BY LOCKWOOD, KESSLER & BARTLETT, INC.

MID-HEIGHT: ± ELEV. 26.3' MSL ≅ ELEV. 40' BRIDGEPORT DATUM

APPROX. MID-HEIGHT LENGTH (ALONG CONTOUR 40' C.B.) ≅ 800'

$\therefore W = 0.4 \times 800' \approx 320'$

TAKE $W_b = \underline{300'}$ (BREACH WIDTH)

(ii) TOTAL HEIGHT AT TIME OF FAILURE

ELEV. ± 46.0' MSL

ELEV. OF STREAMBED ± 10.5' MSL

$y_o \cong 35.5'$

(iii) PEAK FLOOD OUTFLOW Q_{p_1}

$$Q_{p_1} = \frac{8}{27} W_b \sqrt{g}\, y_o^{1.5} \cong \underline{107,000 \text{ cfs}}$$

(iv) APPROXIMATE FLOOD WAVE HEIGHT, IMMEDIATELY D/S OF DAM SITE

$y \cong 0.44\, y_o \cong \underline{16'}$

(2) SUMMARY:

PEAK FAILURE OUTFLOW ≅ 107,000 CFS

STAGE AT IMMEDIATE IMPACT AREA (SKATING RINK) ≅ 16'

BUNNELLS POND DAM

Sheet _____ of _____

ed By _____ Checked By _____

Date _____

look Ref. _____ Other Refs. _____

Revisions _____

NOTE:

THESE COMPUTATIONS HAVE BEEN PERFORMED BASED UPON A DAM BREACH WITH A SURCHARGED WATER SURFACE ELEVATION. IN ACCORDANCE WITH NORMAL CORPS PROCEDURES, COMPUTATIONS ARE PERFORMED BASED UPON A WATER SURFACE ELEVATION AT THE TOP OF THE DAM. A DAM BREACH WITH THE WATER SURFACE AT THE TOP OF THE DAM AND WITHOUT HEAVY DOWNSTREAM CHANNEL FLOW COULD BE MORE CRITICAL THAN A DAM BREACH WITH A SURCHARGE. THE DIFFERENCE, IN THIS CASE, IS NOT SUBSTANTIAL.

INSPECTION OF DAMS – BUNNELL'S POND HLL 7/19/78.

Wilkie's Return tel. Call on 7/19/78.

BUNNELL'S POND. – Checking of Elevs. w/ Mr. CONSIDINE Bridgeport City Eng.

We have maps of Bunnell's pond dated 1948 - showing:

Spillwy Crest Elevs:

West abutment 48.34' (Bridgeport datum)

East abutment 48.37'

Bridgeport Datum −13.51' ≡ USC&GS. (USL)

∴ Ave. Spillw. Elev. 48.355 say 48.36 (CB.*) ≡ 34.85' USL (USC&GS)

*NOTE: THIS IS 1' LOWER THAN WE HAVE TO DATE COMPS.

HLL

APPENDIX

SECTION E: INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
CT	00076	NED	CT	001	04				BUNNELLS POND DAM	1126.0	73113.0	10DEC73

POPULAR NAME	NAME OF IMPOUNDMENT
	BUNNELLS POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	POQUONOCK RIVER	EAST BRIDGEPORT	1	53500

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)
REGA	1906	R	42	40	734	616

REMARKS
20-ESTIMATE

DIS HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
	1050		150					0								

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF BRIDGEPORT		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
DEPT ENV PROT	23JAN74	PA 571 SECT 25-11 ST OF CT

REMARKS